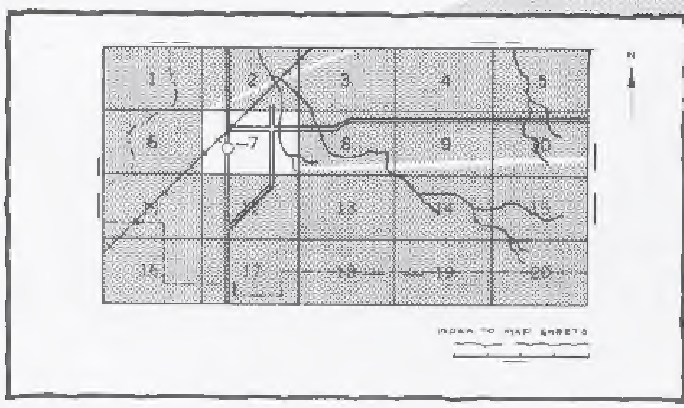
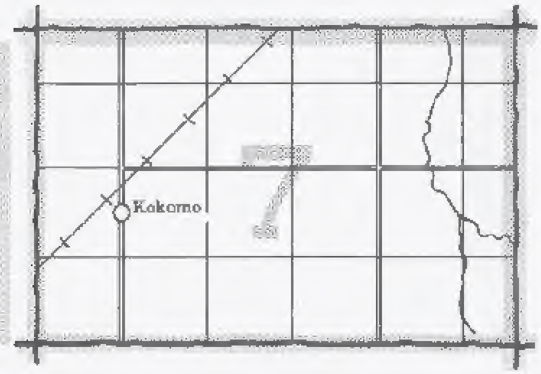
soil survey of
Jackson County, Michigan

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Michigan Agricultural Experiment Station

HOW TO USE

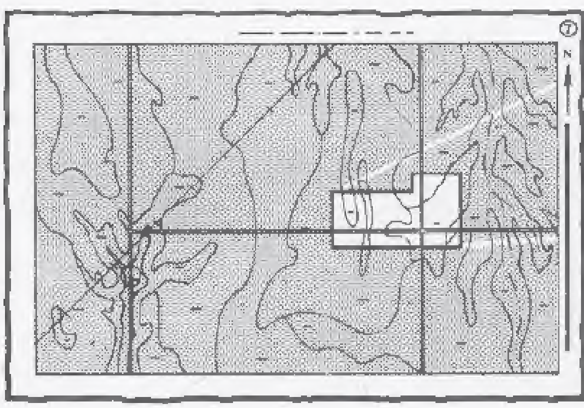
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

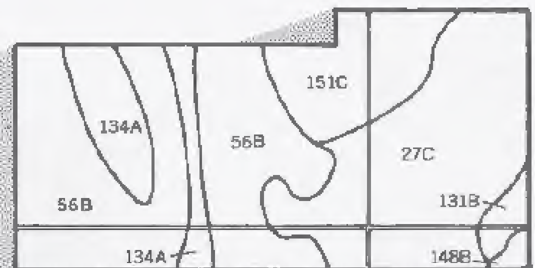




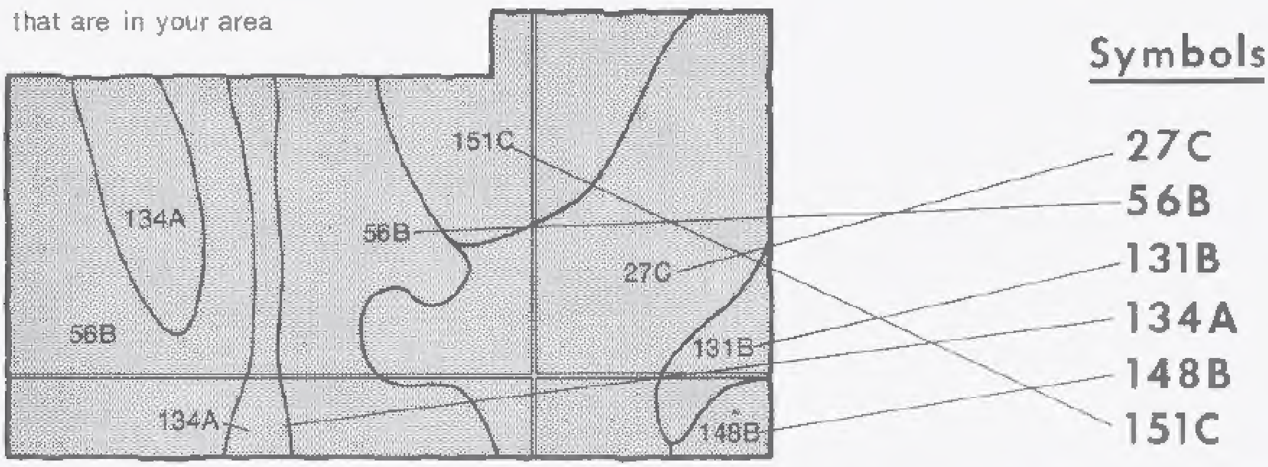
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



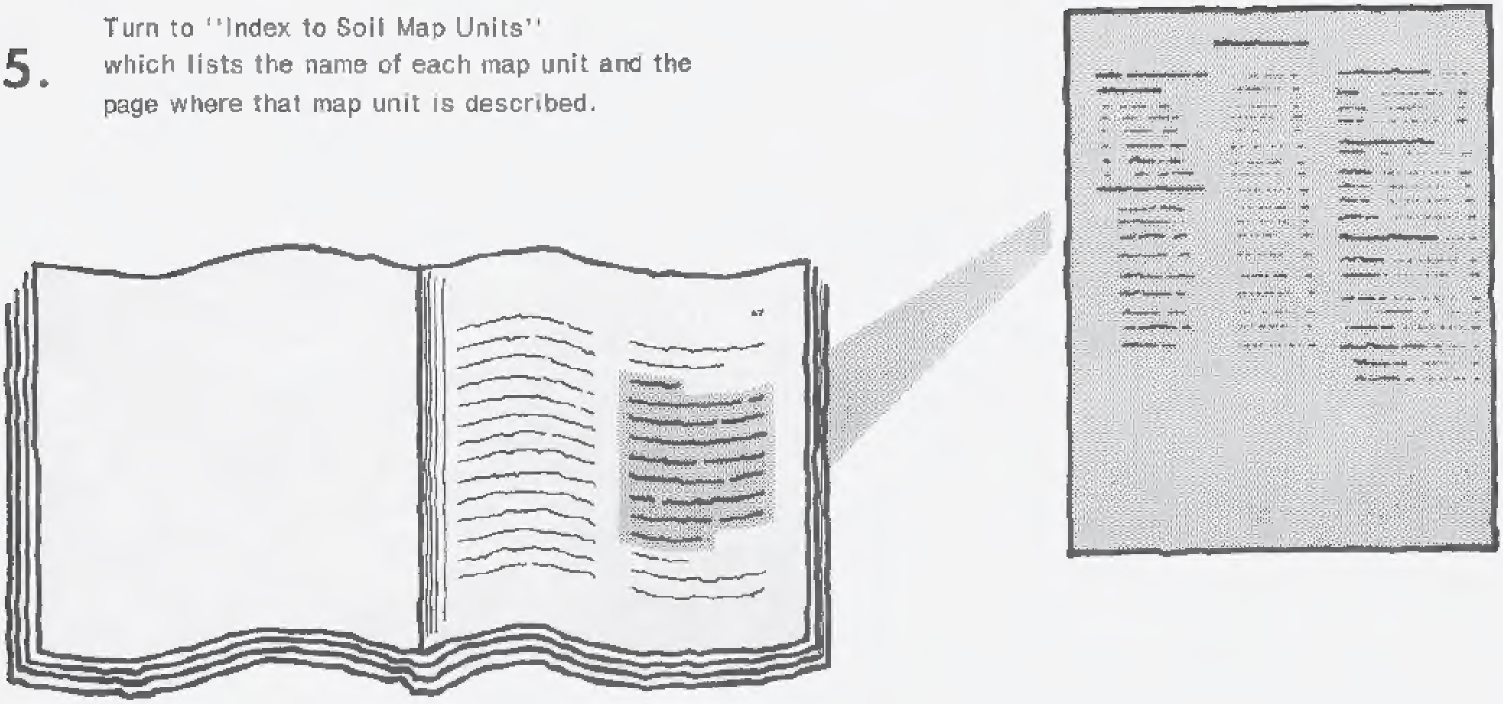


4. List the map unit symbols that are in your area

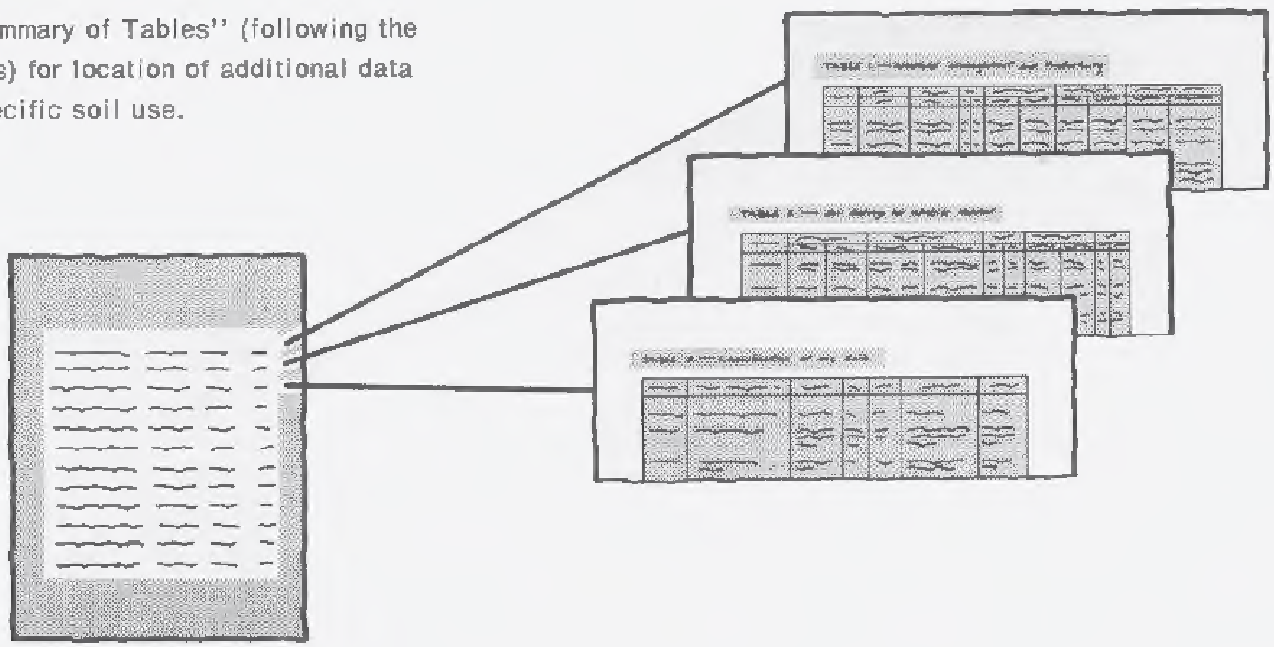


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service and the Michigan Agricultural Experiment Station. It is part of the technical assistance furnished to the Jackson County Soil and Water Conservation District. Major fieldwork for this soil survey was performed in the period 1973-78. Soil names and descriptions were approved in September 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

This soil survey supersedes the soil survey of Jackson County published in 1926 (*7*).

Cover: Typical areas of the Boyer-Oshtemo-Houghton association (foreground) and the Boyer-Hillsdale-Houghton association (background) on the general soil map.

"Preparation of this survey was partly financed by the Jackson County Board of Commissioners under provisions of an agreement with the Soil Conservation Service, United States Department of Agriculture."

contents

soil series

Issued January 1981

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summary of tables

foreword

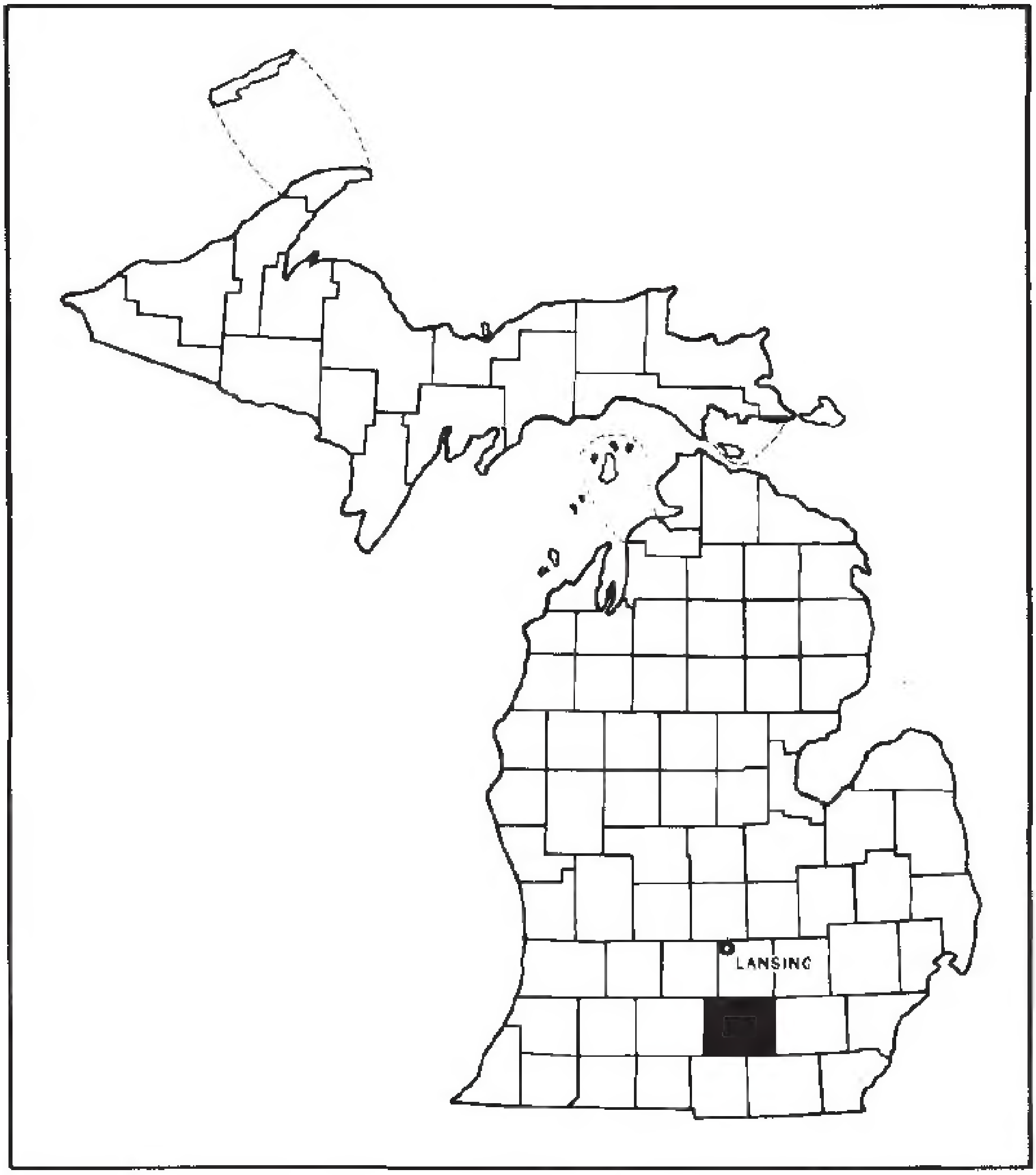
This soil survey contains information that can be used in land-planning programs in Jackson County, Michigan. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed to overcome the limitations or reduce the hazards, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Arthur H. Cratty
State Conservationist
Soil Conservation Service



Location of Jackson County in Michigan.

soil survey of
Jackson County, Michigan

By Robert L. McLeese, Soil Conservation Service

Soils surveyed by James Barnes, William Bowman, Robert Engel, Donald Gibbs, Robert McLeese, Willard Ryland Charles Schwenner, Martin Urka, and Gregory Whitney, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service in cooperation with Michigan Agricultural Experiment Station

JACKSON COUNTY is in the south central part of Michigan's lower peninsula. It has an area of about 717 square miles, or 458,880 acres. The city of Jackson is the county seat and the commercial, industrial, and educational center of the county The population of the county in 1970 was about 143,274.

About 55 percent of the land in the survey area is used for cash crops, dairying, and other farm enterprises. The chief cash crop is corn About 21 percent of the land in the survey area is woodland About 12 percent is urban land and built-up land. About 8 percent of the land in the survey area is idle. About 4 percent is used for parks and other recreation uses. Most of that land is woodland

Soil scientists determined that there are about 62 different kinds of soils in Jackson County. The soils range widely in texture natural drainage, slope, and other characteristics. Well drained soils make up about 60 percent of the survey area, and somewhat poorly drained soils make up about 9 percent. Poorly drained and very poorly drained mineral soils make up about 10 percent of the survey area. Very poorly drained organic soils and Histosols and Aquents, ponded, make up about 17 percent. Urban land complexes, miscellaneous areas, and water areas make up the rest.

general nature of the survey area

This section gives general information about Jackson County It discusses climate physiography, lakes and streams, history and development, farming, and industry and transportation.

climate

Prepared by the Michigan Department of Agriculture Michigan Weather Service, East Lansing, Michigan

Table 1 gives data on temperature and precipitation for the survey area as recorded at Jackson in the period 1948 to 1977. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 24.7 degrees F, and the average daily minimum temperature is 17.4 degrees. The lowest temperature on record, which occurred at Jackson on February 10, 1912, is -21 degrees. In summer the average temperature is 69.8 degrees, and the average daily maximum temperature is 80.9 degrees. The highest recorded temperature, which occurred at Jackson on July 14, 1936, is 105 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall

The total annual precipitation is 29.7 inches. Of this, 17.7 inches, or 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 15.4 inches. The heaviest 1-day rainfall during the period of record was 5.3 inches at Jackson on June 21, 1937. Thunderstorms occur on about 40 days each year More thunderstorms occur in

June than in any other month; however, only slightly fewer occur in July and in August.

Average seasonal snowfall is 37.4 inches. The greatest snow depth at any one time during the period of record was 27 inches. On an average of 63 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity at 1:00 p.m. at the Lansing Capitol City Airport is about 63 percent. Humidity is higher at night, and the average at dawn is about 83 percent. The sun shines 68 percent of the time possible in summer and 36 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12.2 miles per hour, in January.

physiography

Jackson County is in the physiographic division of Michigan's lower peninsula known as the Thumb Upland (7). This is a broad glaciated upland extending from the Ohio-Indiana State line northeastward to Huron County in Michigan.

Most of the topographic features of the county are a result of erosion or deposition during the Wisconsin glaciation, the latest glacial period. The recession of the part of the glacier that covered Michigan began about 14,000 years ago and ended about 8,000 years ago. As the ice melted, a mantle of glacial drift was left on the beds of sandstone, limestone, and other sedimentary bedrock of Paleozoic age. This glacial drift ranges from a few feet to several hundred feet in thickness. It forms various topographic features such as moraines, till plains, outwash plains, glacial drainageways, eskers, and kames.

The Kalamazoo morainic system extending east and west through the northern half of the county is the most prominent moraine. It is generally undulating to very steep. Other moraines in the southwestern and extreme southeastern parts of the county are generally undulating and rolling.

Nearly level to rolling till plains are in the western and northeastern parts of the county and are closely associated with the moraines. A large, nearly level to rolling, pitted outwash plain is in the southeastern part of the county. Other outwash areas are scattered throughout the county. The Grand River, Portage River, North and South Branches of the Kalamazoo River, and River Raisin flow in part through valleys cut by much larger glacial rivers. Many of the lakes in the county are glacial in origin and are in the glacial drainageways. Eskers and kames are mainly in the eastern half of the county.

Marshes and areas of organic soil are important topographic features. They are in old lakebeds and glacial drainageways and are scattered throughout the county but are concentrated in the eastern and northwestern parts.

Bedrock is at a depth of less than 5 feet in a number of areas in the county. In the southwestern part of the county, Marshall Sandstone is near the surface. Bayport Limestone is mined near Parma and Napoleon. Napoleon Sandstone is mined near Napoleon.

The elevation in most of Jackson County is between 950 and 1,050 feet above sea level, or about 275 to 375 feet above Lake Michigan.

lakes and streams

About 700 lakes and ponds are scattered throughout the county. These water areas differ in size, shape, and shoreline characteristics. Some are circular and less than 3 acres, and some are irregularly shaped and more than 800 acres. Some water areas, those on uplands, have clean, sandy shores, some are in marshes and exhibit all stages of filling by vegetation. The larger lakes are concentrated in the eastern half of the county. Among the larger lakes are Lake Columbia, which is about 880 acres; Center Lake, about 850 acres, Clarks Lake, about 510 acres; and Vineyard Lake, about 505 acres.

Jackson County has three major drainage systems, the Grand River, the North and South Branches of the Kalamazoo River, and the River Raisin.

The Grand River drains all but the southwestern and southeastern parts of the county. It has its source in a marsh southwest of Grand Lake and flows to the north. It leaves the county in Tompkins Township and eventually flows into Lake Michigan. The Portage River, Sandstone Creek, and Spring Brook are major tributaries of the Grand River.

The North and South Branches of the Kalamazoo River drain the southwestern part of the county. The source of the North Branch of the Kalamazoo River is in the county, south of Farewell Lake in Hanover Township. Both branches flow to the north, into Calhoun County.

The River Raisin drains the southeastern part of the county. It has its source in Norvell Township and flows to the east, into Washtenaw County and eventually into Lake Erie. Goose Creek is a main tributary.

history and development

The first known inhabitants of the survey area were the Potawatomi Indians, who had migrated from the south before the Revolutionary War. The Potawatomi raised such crops as corn, potatoes, cabbages, and turnips. They also had many apple and wild plum orchards.

The county area was surveyed and laid off just before the summer of 1829. That summer the first settler on record, Horace Blackman of New York, arrived.

Blackman settled along the Grand River, where several Indian trails met. His settlement, which was within a mile of the center of the county and was the natural center of travel, grew quickly.

The county was organized on October 27, 1829, by an act of the Legislative Council of the Territory of

Michigan. The county and the first settlement, by then called Jacksonburg, were named for Andrew Jackson, the seventh president of the United States.

Jackson County was reorganized in 1832. Jacksonburg was made the county seat in 1833. The name "Jacksonburg" was changed to "Jackson" in 1835. From 1832 to 1873 many new townships were organized, and township boundaries and names were changed. By 1836 settlements were scattered throughout the county. In 1873 the final changes were made to the boundaries and names of the political divisions of Jackson County.

Most of the early settlers were farmers, who followed a system of mixed agriculture. Corn, wheat, and potatoes were the staple crops. Cattle, furs, and lumber were additional sources of income. In the late 1800's oats, rye, alfalfa, and navy beans became important crops. Today, corn is the main crop.

The early industries were farm related. Grist mills and sawmills were among the first necessities. Later, coal mines, lime kilns, stone quarries, and lumberyards became important.

Coal was discovered in the county in the 1860's. Coal mining became a major industry, with peak production occurring between 1870 and 1885.

Wagons, buggies, and bicycles were made in the county during the 1800's. Shortly after 1900, the manufacture of automobiles became the important industry. Between 1902 and 1927, 27 different makes of cars were manufactured in Jackson County. Now, no automobiles are manufactured in the county; however, automotive accessories are still manufactured.

farming

From settlement until the late 1800's the acreage under cultivation increased rapidly. From the late 1800's until the 1920's the acreage increased at a much slower rate. Since the 1920's the acreage under cultivation has slowly declined. In 1925 there were about 3,550 farms, with a total acreage of 401,432 (*7*). In 1974 there were about 1,391 farms in the county, with a total acreage of 250,652 (*11*).

In 1946 the Jackson County Soil and Water Conservation District was formed to assist landowners in preventing soil erosion and pollution.

Corn is the main crop in Jackson County. Small grains, hay crops, specialty crops, orchard crops, dairy products, and livestock are also important.

Because of the suitability of many of the soils for use as cropland and the favorable climatic conditions, farming will probably continue to be an important part of the county's economy.

industry and transportation

About 150 manufacturing establishments are in Jackson County. Aircraft components, air cleaners, air conditioners, automotive accessories, baked goods, crates and pallets, electronic equipment, infants' wear, orthopedic appliances, photographic equipment, and wooden boxes are among the items produced.

Deposits of sandstone and limestone bedrock are in some parts of the county. They are mined for use in the construction of roads and buildings and for patio stone. The coarse sand and gravel in many areas in the county are important as roadfill. A few oil wells, natural gas wells, and brine wells are in the southwestern part of the county.

Two airports serve the county. One, west of Jackson, provides regularly scheduled freight and passenger service. The other, northwest of Napoleon, serves small private planes.

Five railroad lines—four for freight and one for passengers—serve the county.

One interstate highway, one U.S. highway, and seven state highways are in the county. These highways link Jackson County to all points in the state.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes, the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit, or soil association, on the general soil map is a unique natural landscape. Typically, a soil association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in other associations but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

soil descriptions

dominantly nearly level to rolling, deep and moderately deep soils that are well drained and somewhat excessively drained

The soils in these associations are generally suited to use as cropland. If they are cultivated, soil blowing and water erosion are hazards.

These soils are suitable for onsite waste disposal and for building site development if proper design and construction procedures are used. Shrink-swell potential, depth to rock, and slope are limitations to these uses.

1. Hillsdale-Riddles association

Deep, well drained, loamy soils that formed in glacial till

This association consists of nearly level to rolling soils on till plains and moraines. The slope is dominantly 0 to 12 percent. It is steeper along the major drainageways and streams.

This association makes up about 8 percent of the survey area. It is about 50 percent Hillsdale soils, 25 percent Riddles soils, and 25 percent soils of minor extent.

The Hillsdale soils have a surface layer of dark grayish brown sandy loam and a subsurface layer of dark yellowish brown sandy loam. The subsoil and the substratum are sandy loam.

The Riddles soils have a surface layer of dark brown sandy loam and a subsurface layer of yellowish brown sandy loam. The subsoil is sandy clay loam, clay loam, and sandy loam. The substratum is sandy loam.

The soils of minor extent are the well drained Arkport, Okee, Ormas, and Spinks soils on broad upland areas and on ridges and knolls; the somewhat poorly drained Teasdale soils on broad flat areas, along drainageways, and in shallow depressions; the poorly drained Barry and Colwood soils in depressions and drainageways; the very poorly drained Gilford soils in depressions and drainageways; and the very poorly drained Histosols, Aquents, and Palms soils in bogs and other depressional areas.

The soils in this association are used mainly as cultivated cropland. In a few areas they are used as permanent pasture or as woodland. Corn is the main crop.

These soils are well suited to use as cropland and as pasture and hayland. If they are cultivated, controlling soil blowing and water erosion and maintaining a high content of organic matter are concerns of management. Water erosion is a hazard if overgrazing occurs.

The soils in this association are suitable for use as woodland. Planting sites must be intensively prepared and maintained to control plant competition.

These soils are suited to onsite waste disposal and to most building site development. Slope is a limitation to the use of these soils as septic tank absorption fields or for building site development. Also, the shrink-swell potential is a limitation on building sites.

2. Hillsdale-Eleva-Riddles association

Deep and moderately deep, well drained and somewhat excessively drained, loamy soils that formed in glacial till, in material that weathered from sandstone, or in glacial drift over sandstone

This association consists of nearly level to rolling soils on till plains and moraines (fig. 1). The slope is dominantly 0 to 12 percent. It generally is steeper along the major drainageways.

This association makes up about 3 percent of the survey area. It is about 35 percent Hillsdale soils, 30 percent Eleva soils, 25 percent Riddles soils, and 10 percent soils of minor extent.

The Hillsdale soils are deep and well drained. They have a surface layer of dark grayish brown sandy loam

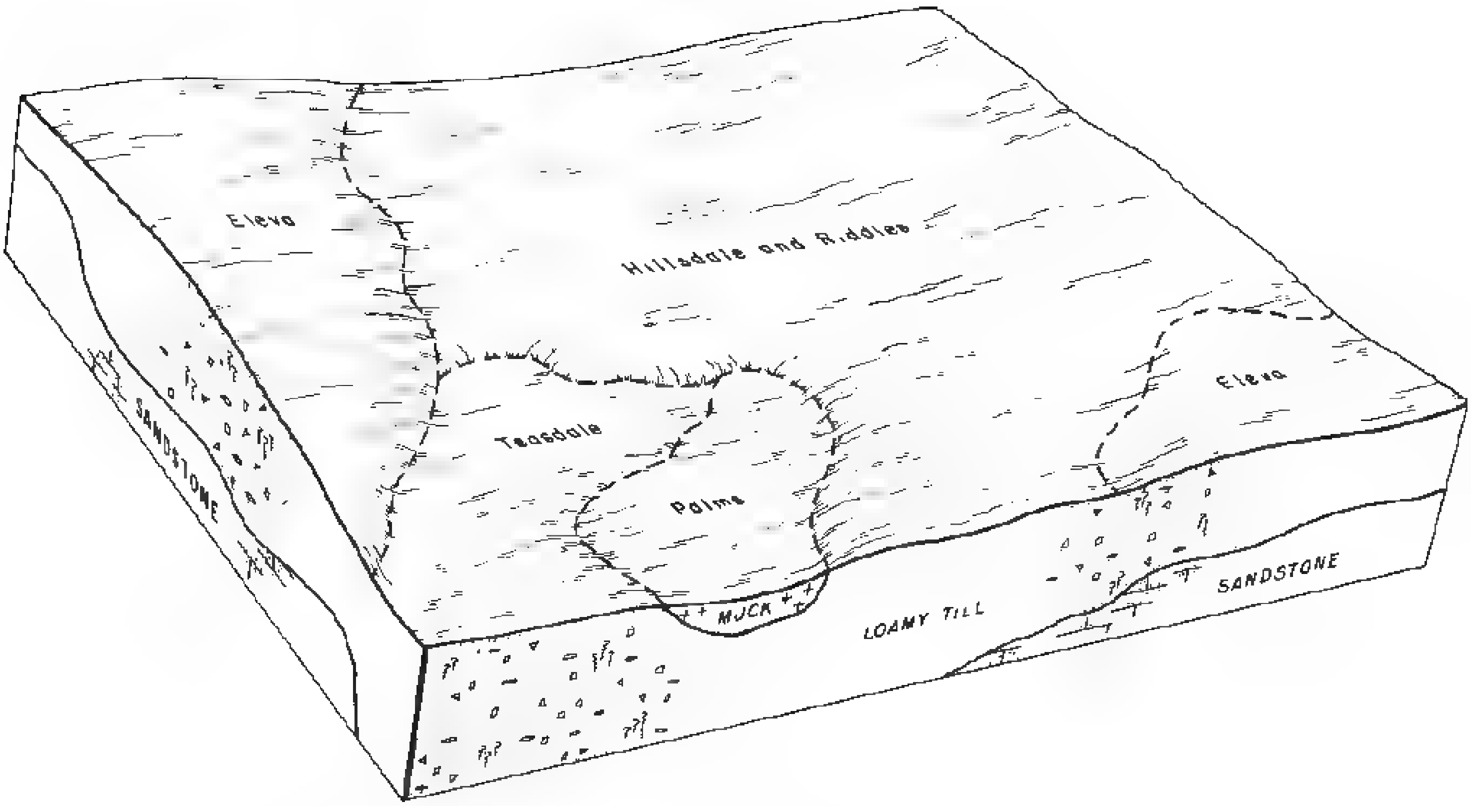


Figure 1. Typical pattern of the soils and underlying material in the Hillsdale-Eleva-Riddles association.

and a subsurface layer of dark yellowish brown sandy loam. The subsoil and the substratum are sandy loam

The Eleva soils are moderately deep and well drained or somewhat excessively drained. They have a surface layer of dark brown sandy loam and a subsurface layer of yellowish brown sandy loam. The subsoil is sandy loam. The substratum is weathered sandstone and channery loamy sand Unweathered sandstone bedrock underlies the substratum.

The Riddles soils are deep and well drained They have a surface layer of dark brown sandy loam and a subsurface layer of yellowish brown sandy loam. The subsoil is sandy clay loam, clay loam, and sandy loam. The substratum is sandy loam

The soils of minor extent are the well drained Ormas Spinks, and Whalan soils in broad upland areas or on ridges and knolls; the somewhat poorly drained Teasdale soils in broad flat areas, along drainageways, and in shallow depressions, the poorly drained Colwood soils in depressions and drainageways, the very poorly drained Gilford soils in depressions and drainageways; and the very poorly drained Palms soils in bogs, drainageways, and other depressional areas

The soils in this association are used mainly as cultivated cropland In a few areas they are used as permanent pasture or as woodland. Corn is the main crop.

These soils are suited to use as cropland and as pasture and hayland. If they are cultivated, controlling soil blowing and water erosion and maintaining a high organic matter content are concerns of management. Droughtiness is a hazard on the Eleva soils. Water erosion and soil blowing are hazards if overgrazing occurs.

The soils in this association are suitable for use as woodland The use of these soils as septic tank absorption fields or for building site development is limited by depth to bedrock and slope. Also, the shrink-swell potential is a limitation on building sites. The Hillsdale and Riddles soils are suited to use as septic tank absorption fields and to most kinds of building site development. The Eleva soils are not suited to these uses because of the depth to bedrock.

3. Urban land-Oshtemo association

Urban land and deep, well drained, loamy soils that formed in glaciofluvial deposits

This association consists of built-up areas and nearly level to rolling soils on outwash plains, till plains, and moraines. The slope ranges from 0 to 30 percent but generally is less than 12 percent.

This association makes up about 3 percent of the survey area. It is about 50 percent Urban land, 10 percent Oshtemo soils, and 40 percent soils of minor extent.

Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the soils is not feasible.

The Oshtemo soils have a surface layer of dark brown sandy loam and a subsurface layer of yellowish brown sandy loam. The subsoil is gravelly sandy loam, gravelly sandy clay loam, and sand with bands of loamy sand. The substratum is gravelly sand.

The soils of minor extent are the well drained Leoni, Ormas, and Spinks soils on ridges and knolls; the well drained Hillsdale and Riddles soils in broad upland areas and on ridges and knolls; the somewhat poorly drained Brady soils in broad flat areas, on low knolls, along drainageways, and in shallow depressions; the poorly drained Barry soils in broad flat areas, depressions, and drainageways; the poorly drained Colwood soils in depressions and drainageways; and the very poorly drained Gilford and Palms soils in depressions and drainageways. Areas of Udorthents and Udipsamments are scattered throughout the association. Also scattered throughout the association are areas of somewhat excessively drained and well drained Eleva soils.

The Oshtemo soils, which make up the lawns, gardens, parks, and other open parts of the association, are well suited to these uses and to most kinds of building site development. These soils are poorly suited to onsite waste disposal because they have poor filtering capacity. A public sewer system should be used if possible.

dominantly nearly level to rolling, deep soils that are well drained, somewhat poorly drained, and very poorly drained

The soils in these associations are generally suited to use as cropland. If they are cultivated, soil blowing and water erosion are hazards. Removing excess water during wet periods and maintaining good soil tilth are concerns of management.

The suitability of these soils for onsite waste disposal and for use as building sites is fair to poor. Permeability, depth to the water table, shrink-swell potential, low strength, and slope are limitations to these uses. The very poorly drained organic soils are not suited to these uses.

4. Hillsdale-Riddles-Teasdale association

Deep, well drained and somewhat poorly drained, loamy soils that formed in glacial till

This association consists of nearly level to rolling soils on till plains and moraines (fig. 2). The slope is dominantly 0 to 12 percent. The Hillsdale and Riddles soils are in broad upland areas. In these areas the slope is generally steeper along the major drainageways and streams. The Teasdale soils are on the lower positions on the landscape.

This association makes up about 22 percent of the survey area. It is about 25 percent Hillsdale soils, 20 percent Riddles soils, 10 percent Teasdale soils, and 45 percent soils of minor extent.

The Hillsdale soils are deep and well drained. They have a surface layer of dark grayish brown sandy loam and a subsurface layer of dark yellowish brown sandy loam. The subsoil and the substratum are sandy loam.

The Riddles soils are deep and well drained. They have a surface layer of dark brown sandy loam and a subsurface layer of yellowish brown sandy loam. The subsoil is sandy clay loam, clay loam, and sandy loam. The substratum is sandy loam.

The Teasdale soils are deep and somewhat poorly drained. They have a surface layer of dark brown fine sandy loam and a subsurface layer of yellowish brown fine sandy loam. The subsoil and the substratum are fine sandy loam.

The soils of minor extent are the well drained Arkport, Okee, Ormas, and Spinks soils in broad upland areas, on ridges and knolls, and along drainageways; the somewhat poorly drained Dixboro soils in broad flat areas, on low ridges and knolls, on foot slopes, and along drainageways; the poorly drained Barry and Colwood soils in depressions and drainageways; the very poorly drained Gilford soils in depressions and drainageways; and the very poorly drained Houghton and Palms soils in bogs, drainageways, and other depressional areas.

The soils in this association are used mainly as cultivated cropland. In a few areas they are used as permanent pasture or as woodland. Corn is the main crop.

These soils are suited to use as cropland and as pasture and hayland. If they are cultivated, controlling soil blowing and water erosion, maintaining a high content of organic matter, removing excess water, and maintaining good soil tilth are concerns of management. If overgrazing occurs on the Hillsdale and Riddles soils, water erosion is a hazard. Grazing on the Teasdale soils when they are too wet can cause surface compaction.

The soils in this association are suitable for use as woodland. Planting sites must be intensively prepared and maintained, however, to control plant competition.

These soils can be used as septic tank absorption fields or for building site development, however, shrink-swell potential, slope, and depth to the water table are limitations to these uses

5. Riddles-Teasdale-Palms association

Deep, well drained, somewhat poorly drained, and very poorly drained, loamy and mucky soils that formed in glacial till or in organic material and the underlying loamy glaciofluvial deposits

This association consists of nearly level to rolling soils on till plains and moraines, and in isolated areas of glacial till on outwash plains. The Riddles soils are in the broad upland areas the Teasdale soils are in the lower lying broad and flat upland areas, and the Palms soils in depressional areas. The slope is dominantly 0 to 12 percent. It is generally steeper along the major drainageways and streams.

This association makes up about 14 percent of the survey area. It is about 55 percent Riddles soils, 10 percent Teasdale soils, 10 percent Palms soils, and 25 percent soils of minor extent

The Riddles soils are deep and well drained They have a surface layer of dark brown sandy loam and a subsurface layer of yellowish brown sandy loam. The subsoil is sandy clay loam, clay loam, and sandy loam. The substratum is sandy loam

The Teasdale soils are deep and somewhat poorly drained. They have a surface layer of dark brown fine sandy loam and a subsurface layer of yellowish brown fine sandy loam. The subsoil and the substratum are fine sandy loam.

The Palms soils are deep and very poorly drained. They consist of black muck to a depth of about 32 inches The substratum to a depth of about 60 inches is sandy loam and loamy sand.

The soils of minor extent are the well drained Arkport, Okee, Ormas, Spinks and Leoni soils in broad, flat upland areas, on ridges and knolls, and along drainageways the poorly drained Barry and Colwood soils in depressions and drainageways; the very poorly drained Gilford soils in depressions and drainageways; and the very poorly drained Houghton soils in bogs, drainageways, and other depressional areas.

The soils in this association are used mainly as cultivated cropland. Corn is the main crop. In a few areas the soils are used as permanent pasture or as woodland. Most areas of the Palms soils have a cover of natural vegetation, including trees; a few areas have been drained for use as cropland

The upland soils of this association are suited to use as cropland and as pasture and hayland. If these soils are cultivated, controlling water erosion, maintaining good soil tilth and a high content of organic matter, and removing excess water during wet periods are concerns of management. The Palms soils are suited to use as cropland if adequate drainage is provided. If they are cultivated removing excess water, preventing ponding, providing adequate drainage outlets, controlling soil blowing, controlling subsidence after drainage, and overcoming equipment limitations associated with soil stability are concerns of management.

If overgrazing occurs on the Riddles soils, water erosion is a hazard Grazing on the Teasdale soils when they are wet can cause surface compaction. The Palms soils are suited to use as pasture and hayland if adequate drainage is provided.

The soils in this association are suitable for use as woodland. Plant competition is a concern of management. Equipment limitations, seedling mortality, and windthrow are additional concerns of management if the Palms soils are used as woodland.

The upland soils can be used as septic tank absorption fields or for building site development; however, shrink-swell potential, slope, and depth to the water table are limitations to these uses The Palms soils are not suited to these uses.

6. Marlette-Capac-Houghton association

Deep, well drained, somewhat poorly drained, and very poorly drained, loamy and mucky soils that formed in glacial till or in organic material

This association consists of nearly level to rolling soils on till plains and moraines and in isolated areas of glacial till on outwash plains. The Marlette soils are in broad upland areas, the Capac soils are on foot slopes and low positions on the landscape, and the Houghton soils are in depressional areas. The slope is dominantly 0 to 12 percent. It is generally steeper along the major drainageways and streams.

This association makes up about 3 percent of the survey area. It is about 35 percent Marlette soils, 20 percent Capac soils, 10 percent Houghton soils, and 35 percent soils of minor extent.

The Marlette soils are deep and well drained. They have a surface layer of dark brown loam. The subsoil is clay loam that has loam coatings on faces of peds in the upper part. The substratum is loam.

The Capac soils are deep and somewhat poorly drained. They have a surface layer of very dark grayish brown loam. The subsoil is loam and clay loam. The substratum is loam.

The Houghton soils are deep and very poorly drained. They have a surface layer of black muck. The underlying layers are muck.

The soils of minor extent are the well drained Arkport, Okee, Ormas, and Spinks soils in broad upland areas and on ridges and knolls; the poorly drained Barry and Colwood soils in depressions and drainageways; the very poorly drained Gilford soils in depressions and

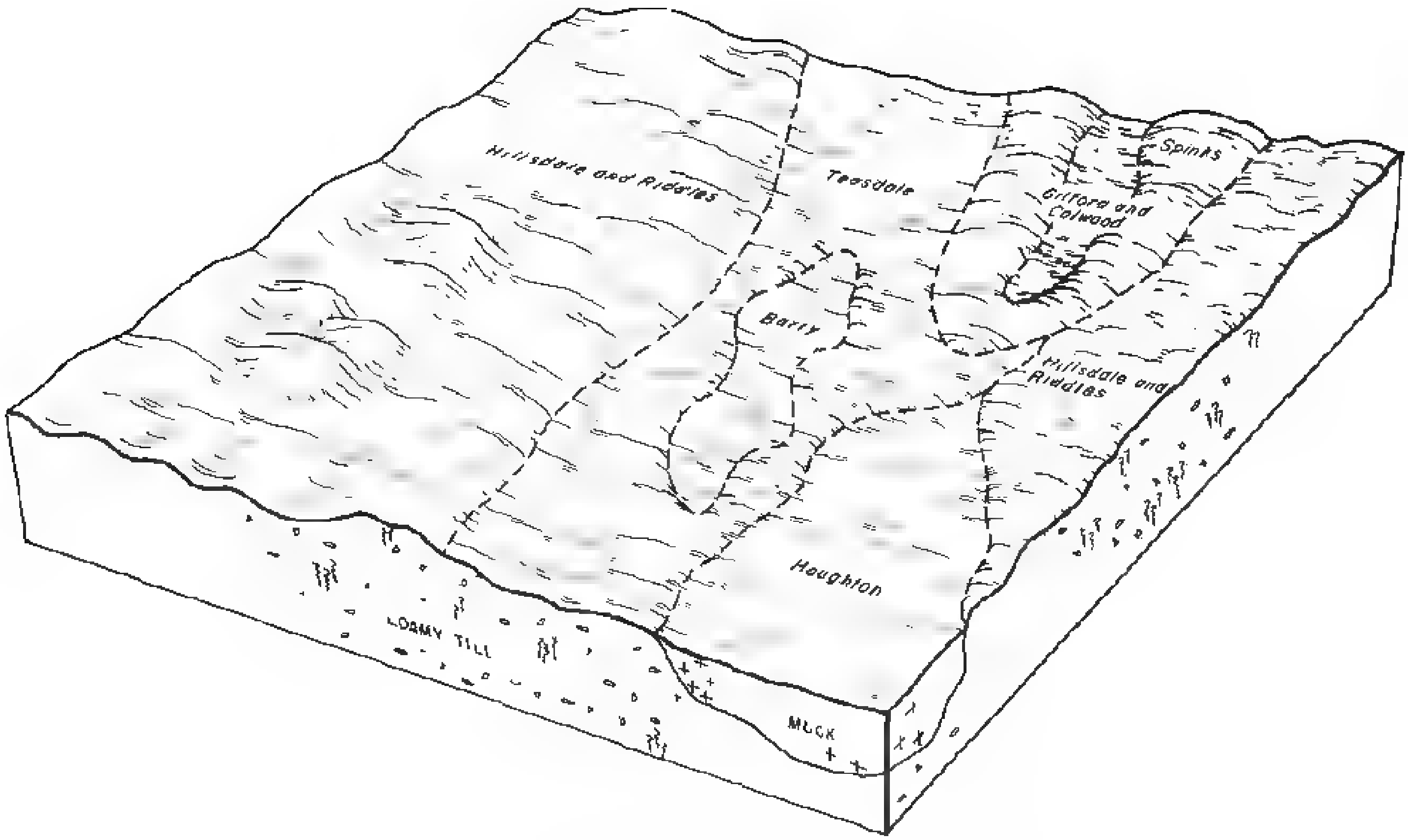


Figure 2.—Typical pattern of the soils and underlying material in the Hillsdale-Riddles-Teasdale association.

drainageways; and the very poorly drained Palms soils in bogs, depressions, and drainageways.

The soils in this association are used mainly as cultivated cropland. Corn is the main crop. In a few areas the soils are used as permanent pasture or as woodland. Most areas of the Houghton soils have a cover of natural vegetation, including trees.

The Marlette and Capac soils are suited to use as cropland and as pasture and hayland. If these soils are cultivated, controlling water erosion, maintaining good soil tilth and a high content of organic matter, and removing excess water during wet periods are concerns of management. The Houghton soils are suited to use as cropland if they are adequately drained.

If overgrazing occurs on the Marlette soils, water erosion is a hazard. Grazing on the Capac soils when they are wet can cause surface compaction. The Houghton soils are suited to use as pasture and hay if adequate drainage is provided.

The soils in this association are suitable for use as woodland. Plant competition is a concern of management. Equipment limitations, seedling mortality, and windthrow hazard are additional concerns if the Houghton soils are used as woodland.

The Marlette and Capac soils can be used as septic tank absorption fields or for building site development; however, shrink-swell potential, low strength, permeability, slope, and depth to the water table are limitations that affect building site development and permeability, slope, and depth to the water table are limitations that affect septic tank absorption fields. The Houghton soils are not suited to these uses.

dominantly nearly level to rolling, deep soils that are well drained and very poorly drained

The soils in these associations are generally suited to use as cropland. If they are cultivated, soil blowing, water erosion, and droughtiness are hazards.

The well drained soils in these associations are suited to most building site development; however, slope is a limitation in some areas. If these soils are used for onsite waste disposal pollution of ground water is a hazard because of inadequate filtration of the effluent. Onsite waste disposal and building site development are not practical on the very poorly drained organic soils in these associations.

7. Spinks-Ormas-Houghton association

Deep, well drained and very poorly drained, sandy and mucky soils that formed in glaciofluvial deposits or in organic material

This association consists of nearly level to rolling soils on outwash plains, in glacial drainageways, and on moraines (fig. 3). The Spinks and Ormas soils are in the broad upland areas, and the Houghton soils are in depressional areas. The slope is dominantly 0 to 12 percent.

This association makes up about 23 percent of the survey area. It is about 25 percent Spinks soils, 15 percent Ormas soils, 10 percent Houghton soils, and 50 percent soils of minor extent.

The Spinks soils are deep and well drained. They have a surface layer of dark brown sand and a subsurface layer of brownish yellow and light yellowish brown sand. The underlying layer consists of sand and bands of fine sand.

The Ormas soils are deep and well drained. They have a surface layer of dark brown loamy sand and a subsurface layer of yellowish brown loamy sand. The subsoil is sandy loam, sandy clay loam, loamy sand, and gravelly sandy loam. The substratum is gravelly sand.

The Houghton soils are deep and very poorly drained. They have a surface layer of black muck. The underlying layers are muck.

The soils of minor extent are the well drained Arkport, Okee, Boyer, and Oshtemo soils in broad upland areas, on knolls and ridges, and along drainageways; the somewhat poorly drained Brady and Dixboro soils in broad, flat areas, on low knolls and ridges, on foot slopes, along drainageways, and in shallow depressions; the poorly drained Colwood soils and the very poorly drained Gilford soils in depressions and drainageways; and the very poorly drained Palms soils in bogs and other depressional areas.

The soils in this association are used mainly as cultivated cropland. Corn is the main crop. In a few areas the soils are used as permanent pasture or as woodland. Most areas of the Houghton soils have a cover of natural vegetation, including trees; a few areas have been drained for use as cropland.

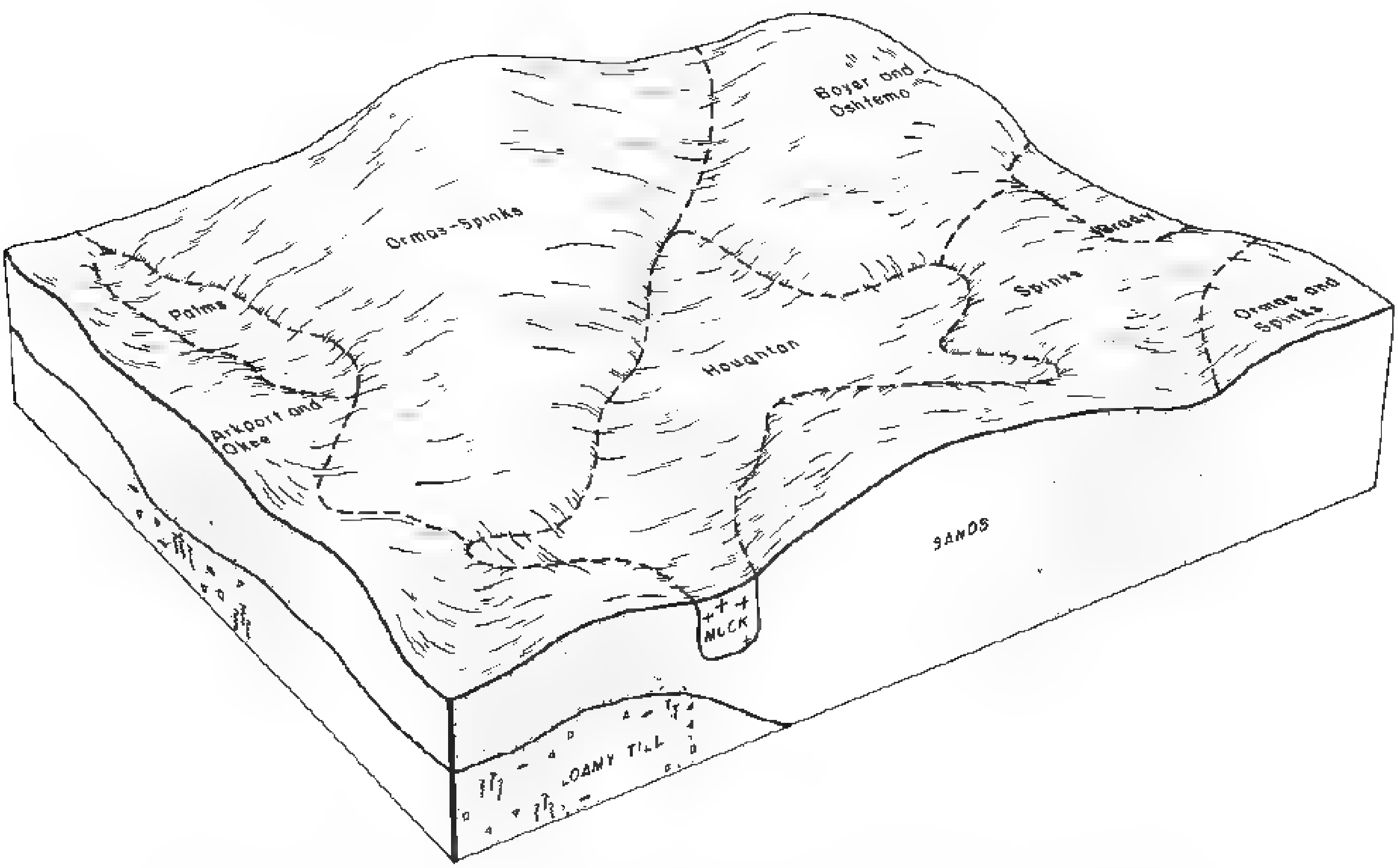


Figure 3.—Typical pattern of the soils and underlying material in the Spinks-Ormas-Houghton association.

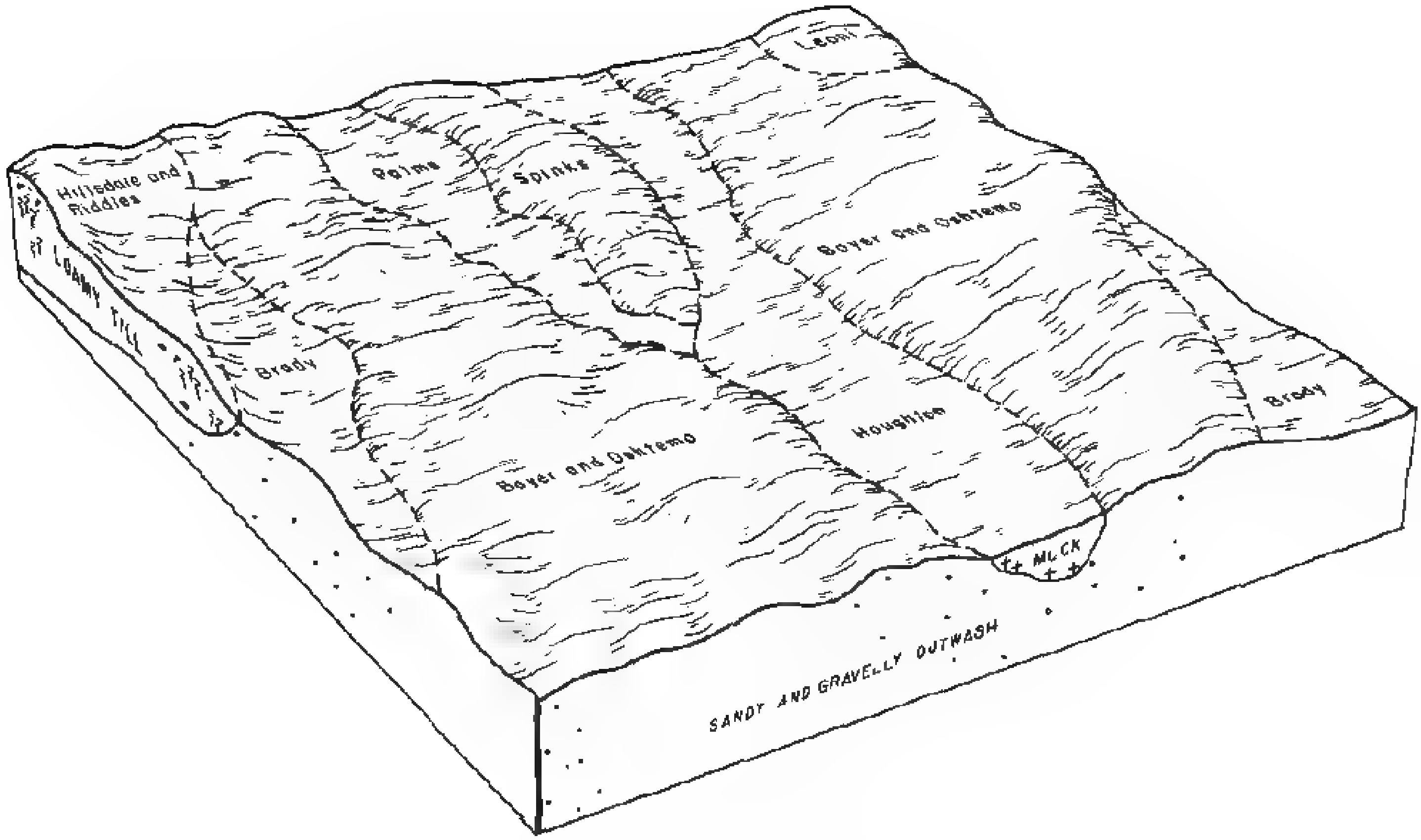


Figure 4.—Typical pattern of the soils and underlying material in the Boyer-Oshtemo-Houghton association

The well drained soils are suited to use as cropland and as pasture and hayland. If they are cultivated, controlling water erosion, maintaining a high content of organic matter, and conserving moisture during dry periods are concerns of management. If they are used as pasture or hayland, the hazard of droughtiness is a concern.

The Houghton soils are suited to use as cropland and as pasture and hayland if they are adequately drained. If they are cultivated, removing excess water, preventing ponding, providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and overcoming equipment limitations are concerns of management.

The soils in this association are suitable for use as woodland. Plant competition and seedling mortality are concerns of management. Windthrow hazard and equipment limitations are additional concerns if the Houghton soils are used as woodland.

The well drained soils are well suited to most building site development; however, they are poorly suited to onsite waste disposal. The slope and inadequate filtration capacity of the soils are limitations to these uses. The Houghton soils are not suited to building site development or to onsite waste disposal.

8. Boyer-Oshtemo-Houghton association

Deep, well drained and very poorly drained, loamy and mucky soils that formed in glaciofluvial deposits or in organic material

This association consists of nearly level to rolling soils on outwash plains and moraines and in glacial drainageways (fig. 4). The Boyer and Oshtemo soils are in the broad upland areas, and the Houghton soils are in depressional areas. The slope ranges from 0 to 40 percent.

This association makes up about 19 percent of the survey area. It is about 30 percent Boyer soils, 15 percent Oshtemo soils, 10 percent Houghton soils, and 45 percent soils of minor extent.

The Boyer soils are deep and well drained. They have a surface layer of dark brown sandy loam. The subsoil is sandy loam and gravelly sandy loam. The substratum is very gravelly sand.

The Oshtemo soils are deep and well drained. They have a surface layer of dark brown sandy loam and a subsurface layer of yellowish brown sandy loam. The subsoil is gravelly sandy loam, sandy clay loam, and

sand that contains bands of loamy sand. The substratum is gravelly sand.

The Houghton soils are deep and very poorly drained. They have a surface layer of black muck. The underlying layers are muck.

The soils of minor extent are the well drained Hillsdale, Ormas, Riddles, Spinks, and Leoni soils in broad upland areas, on knolls and ridges, and along drainageways; the somewhat poorly drained Brady soils in broad flat areas and shallow depressions, on knolls and ridges, and along drainageways; the poorly drained Colwood soils and the very poorly drained Gilford soils in depressions and drainageways; and the very poorly drained Palms soils in bogs, depressions, and drainageways.

The soils in this association are used mainly as cultivated cropland. Corn is the main crop. In a few areas the soils are used as permanent pasture or as woodland. Most areas of the Houghton soils have a cover of natural vegetation, including trees, some areas are drained for use as cropland.

The well drained soils are suited to use as cropland and as pasture and hayland. If they are cultivated, controlling water erosion, maintaining a high content of organic matter, and conserving moisture during dry periods are concerns of management. If they are used as pasture or hayland, the hazard of droughtiness is a concern.

The Houghton soils are suited to use as cropland and as pasture and hayland if they are adequately drained. If they are cultivated, removing excess water, preventing ponding, providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and overcoming equipment limitations are concerns of management.

The soils in this association are suitable for use as woodland. Plant competition is a concern of management. Seedling mortality, windthrow hazard, and equipment limitations are additional concerns if the Houghton soils are used as woodland.

The well drained soils are well suited to most kinds of building site development; however, they are poorly suited to onsite waste disposal. Slope and poor filtering capacity are limitations to onsite waste disposal. The Houghton soils are not suited to building site development or to onsite waste disposal.

The soils are poorly very steep and nearly level, deep soils that are well drained and very poorly drained

The soils are poorly suited to use as cropland. They are best suited to use as woodland or pasture.

The well drained soils are poorly suited to onsite waste disposal and to use as building sites because of slope. The very poorly drained organic soils are not suited to these uses.

9. Boyer-Hillsdale-Houghton association

Deep, well drained and very poorly drained, loamy and mucky soils that formed in glaciofluvial deposits, glacial till, or organic material

This association consists of nearly level to very steep soils on moraines. The Boyer and Hillsdale soils are on hills and high ridges, and the Houghton soils are in depressional areas (fig. 5). The slope ranges from 0 to 40 percent.

This association makes up about 2 percent of the survey area. It is about 30 percent Boyer and similar soils, 25 percent Hillsdale and similar soils, 15 percent Houghton soils, and 30 percent soils of minor extent.

The Boyer soils are deep and well drained. They have a surface layer of dark brown sandy loam. The subsoil is sandy loam and gravelly sandy loam. The substratum is very gravelly sand.

The Hillsdale soils are deep and well drained. They have a surface layer of dark grayish brown sandy loam and a subsurface layer of dark yellowish brown sandy loam. The subsoil is sandy loam. The substratum is sandy loam till.

The Houghton soils are deep and very poorly drained. They have a surface layer of black muck. The underlying layers are muck.

The soils of minor extent are the well drained Arkport, Okee, Ormas, Oshtemo, Riddles, Spinks, and Leoni soils on hills and ridges; the poorly drained Colwood soils and the very poorly drained Gilford soils in depressions and drainageways; and the very poorly drained Palms and Napoleon soils in bogs.

This association is used mainly for recreation and as wildlife habitat. Most of the acreage is woodland; a small acreage is permanent pasture.

Crop production is generally not practical on these soils because of the steepness of slope. However, some of the larger areas of Houghton soils, if drained, are suitable for crops, particularly specialty crops.

The soils in this association are suited to pasture plants, which can control erosion. Droughtiness is a hazard to the use of the well drained soils as pasture. Artificial drainage is needed if the Houghton soils are used as pasture.

The soils in this association are well suited to woodland use. Plant competition, seedling mortality, equipment limitations, and the hazards of windthrow and water erosion, however, are concerns of management.

These soils are poorly suited to building site development and to onsite waste disposal. Slope is a limitation on the Boyer and Hillsdale soils. Poor filtering capacity is an additional limitation on the Boyer soils. The Houghton soils are not suited to building site development or to onsite waste disposal.

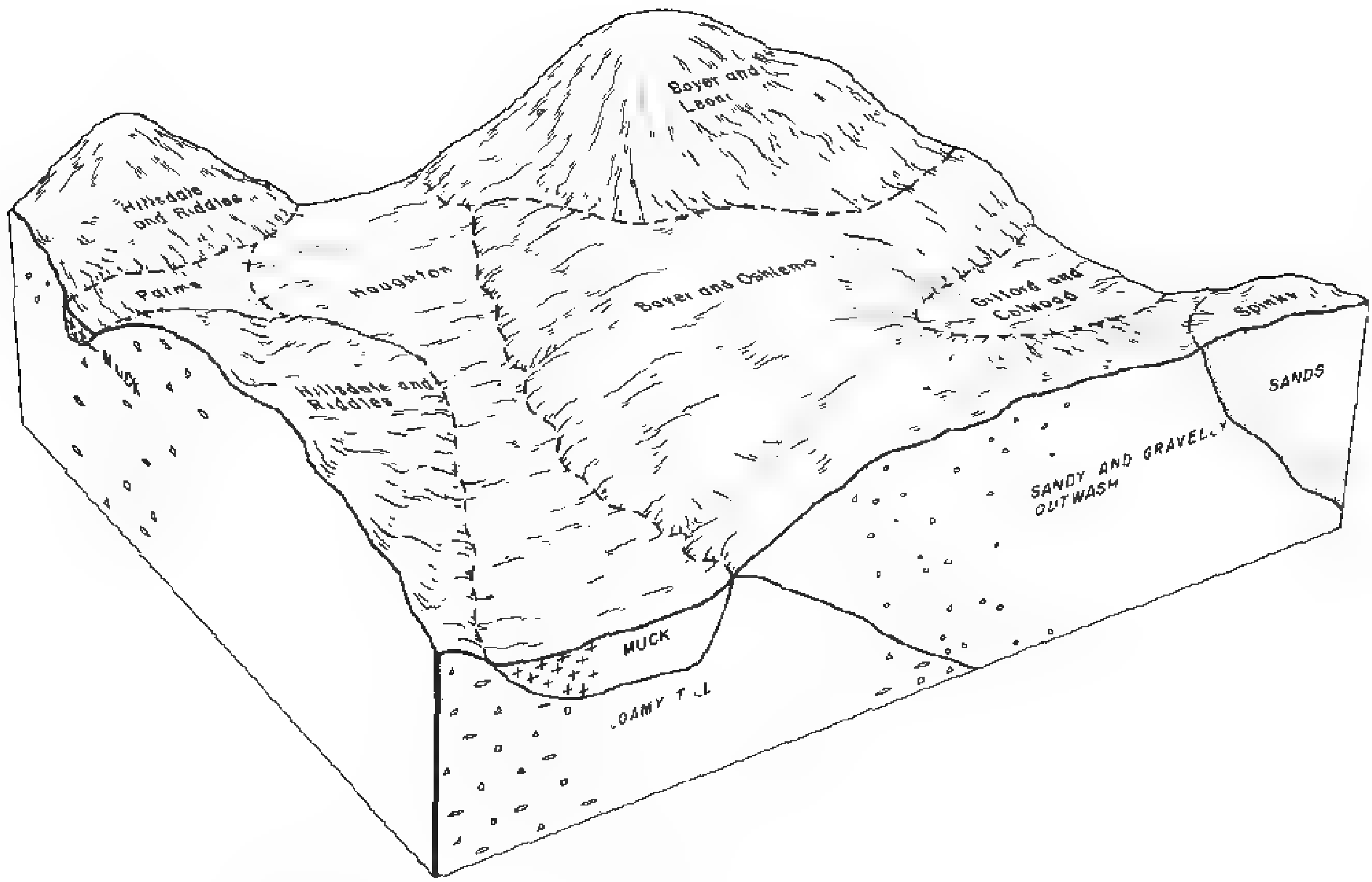


Figure 5.—Typical pattern of the soils and underlying material in the Boyer-Hillsdale-Houghton association.

dominantly nearly level, deep soils that are very poorly drained

These soils are suited to specialty crops if adequately drained. If they are cultivated, removing excess water, preventing ponding, providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and overcoming equipment limitations associated with low soil stability are concerns of management.

The soils are not suited to onsite waste disposal and to building site development.

10. Houghton-Palms-Henrietta association

Deep, very poorly drained, mucky soils that formed in organic material or in organic material and the underlying loamy and sandy glaciofluvial deposits

This association consists of soils in an old glacial drainageway (fig. 6). In this association the slope is generally less than 2 percent. In the adjacent upland areas the slope is as much as 30 percent.

This association makes up about 3 percent of the survey area. It is about 30 percent Houghton soils, 20 percent Palms soils, 20 percent Henrietta soils, and 30 percent soils of minor extent.

The Houghton soils have a surface layer of black muck. The underlying layers are muck.

The Palms soils consist of black muck in the upper part and of sandy loam and loamy sand in the substratum.

The Henrietta soils are deep and very poorly drained. They have a surface layer of black muck. The subsoil is loamy fine sand, sandy loam, silt loam, and fine sandy loam. The substratum is loamy fine sand.

The soils of minor extent are the well drained Arkport, Okee, Ormas, and Spinks soils on ridges and knolls, the somewhat poorly drained Dixboro soils on foot slopes and along drainageways; the poorly drained Colwood and Sebewa soils and the very poorly drained Gilford soils in depressions and drainageways; and the very poorly drained Edwards and Martisco soils along the edge of lakes and in depressions.

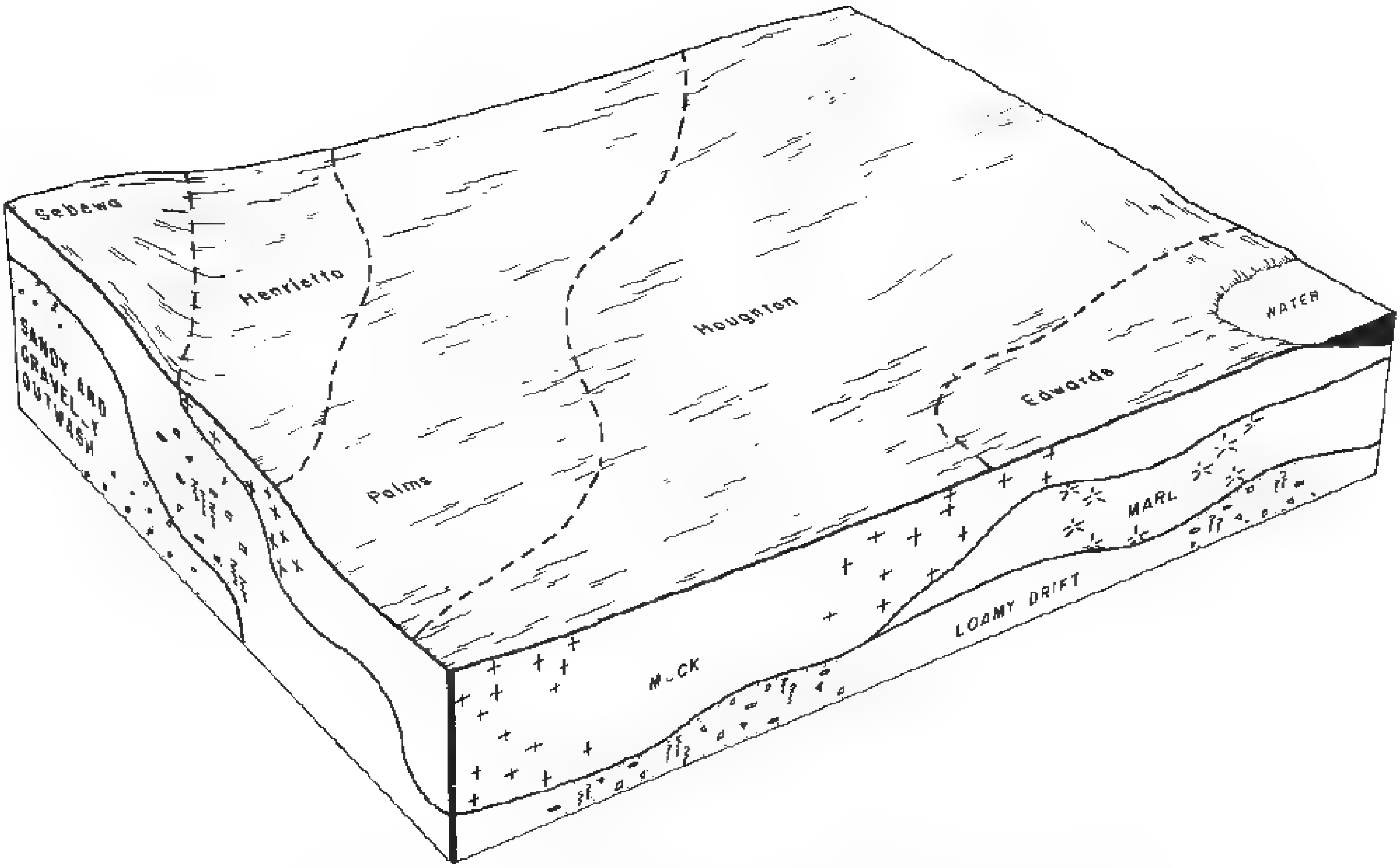


Figure 6.—Typical pattern of the soils and underlying material in the Houghton-Palms-Henrietta association.

In most of the area the soils have a cover of natural vegetation, including trees, and they are used mainly for recreation areas and as wildlife habitat. In places, they are used for cultivated crops. Specialty crops, such as lettuce, onions, mint, and sod, are the most common crops.

The soils in this association are suitable for use as cropland if adequate drainage is provided. If they are cultivated, removing excess water, preventing ponding (fig. 7), providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and overcoming equipment limitations are concerns of management. Frost action is a hazard in some areas. These soils may be deficient in nutrients, especially micronutrients, for some crops.

These soils are suitable for use as pasture and hayland if artificial drainage is provided. The ponding is a hazard to these uses. Removing excess water and preventing surface compaction are concerns of management.

The soils in this association are suited to use as woodland. Equipment limitations, plant competition, seedling mortality, and the hazard of windthrow are concerns of management.

The use of these soils as septic tank absorption fields or for building site development is not practical. The high water table, hazard of ponding, and instability of the soil material are limitations that are extremely difficult to overcome.

broad land use considerations

The soils in Jackson County vary widely in their suitability for major land uses.

cropland

About 30 percent of the land in the county is used for cultivated crops, mainly corn and wheat. This cropland is scattered throughout the county and is concentrated in associations 1, 2, 4, 5, 6, 7, and 8. The soils in these associations are generally suited to crops.

Associations 1 and 2 are dominantly nearly level to rolling uplands. The hazards of erosion and soil blowing

are the main concerns of cropland management on the soils in these associations. In associations 4, 5, and 6, cultivated crops are grown mainly on the nearly level to rolling upland soils. The hazards of erosion and soil blowing, removing excess water during wet periods, and maintaining good soil tilth are concerns of cropland management on these soils. In associations 7 and 8, the crops are grown mainly on the nearly level to rolling, well drained upland soils. The hazards of erosion, soil blowing, and droughtiness are concerns of cropland management on these soils.

The very poorly drained organic soils in associations 5, 6, 7, and 8 are generally not cultivated. However, in some of the larger areas they have been cleared and drained and are suitable for crops, particularly specialty crops such as lettuce, celery, onions, and mint, and for sod. If these soils are cultivated, removing excess water, preventing ponding, providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and equipment limitations associated with soil stability are concerns of management. Specialty crops are also grown in some places in association 10.

pasture and hayland

About 6 percent of the land in the county is permanent pasture, and 6 percent is hayland in a tillage rotation. The soils in associations 1, 2, 4, 5, 6, 7, 8, and 9 are generally suited to use as pasture and hayland. Most of the pasture is on the rolling to very steep upland soils. Some pasture is on the soils in association 10. Pasture grasses help to control erosion.

woodland

About 25 percent of the county is in woodland. The productivity of hardwoods is high and very high on the upland soils in associations 1, 4, 5, 6, and 9 and moderately high to very high on the upland soils in associations 2, 7, and 8. It is moderately high on the soils in association 10 and on the very poorly drained organic soils in associations 5, 6, 7, 8, and 9. Plant competition is the main concern on woodland in Jackson County. Erosion, equipment limitations, seedling mortality, and windthrow hazard are additional concerns of management for some soils.

recreation

The soils are poorly suited to well suited to use as sites for recreation, depending on the intensity of the expected use. Most of the soils in associations 1, 2, 4, 5, 6, 7, and 8 are generally suited to intensive recreation uses such as playgrounds, camp areas, picnic areas, and paths and trails. Wetness is a limitation to these uses on the very poorly drained organic soils in associations 5, 6, 7, and 8 and the somewhat poorly drained upland soils in associations 4, 5, and 6. The sandy texture of the well drained soils in association 7 is also a limitation to these uses.

The soils in associations 9 and 10 are generally poorly suited to intensive recreation development. The rolling to very steep slopes in association 9 and the high water table in association 10 are limitations to this use. Most of the land area of associations 9 and 10 is within the Waterloo Recreation Area. This area is used primarily for

Figure 7.—Ponded area of the Houghton-Palms-Henrietta association.

wildlife habitat, hunting, and fishing. The soils are well suited to these uses.

wildlife habitat

The suitability of the soils for use as wildlife habitat is generally high throughout the county. The soils in associations 1, 2, 4, 5, 6, 7, 8, and 9 are generally suitable for use as habitat for openland and woodland wildlife. The very poorly drained organic soils in associations 5, 6, 7, 8, and 9 and the somewhat poorly drained soils in associations 4, 5, and 6 are also suited to use as habitat for wetland wildlife. The soils in association 10 are suited to use as habitat for wetland wildlife.

urban land

About 12 percent of the land in the county is classified as urban, or built-up, land. Urban land is concentrated in association 3, but it is scattered throughout the county. Association 3 is so built up that most uses are precluded.

The nearly level to rolling, well drained Hillsdale and Riddles soils in associations 1, 2, 4, and 5 are generally suited to urban uses. These soils have slight to moderate limitations for most building site development and for onsite waste disposal. Slope, shrink-swell potential, and filtering capacity are limitations to these uses.

The nearly level to rolling, well drained Marlette, Spinks, Ormas, Boyer, and Oshtemo soils in associations 3, 6, 7, and 8 have slight to moderate limitations for most kinds of building site development but have severe limitations for use as septic tank absorption fields.

The soils in association 9 are poorly suited to most urban uses because of wetness and the steepness of slope. Some sites are, however, suitable for houses.

The nearly level to rolling, well drained Arkport and Okee soils, which are of minor extent in associations 1, 4, 5, 6, 7, 9, and 10, are well suited to urban uses. These soils have slight to moderate limitations for most kinds of building site development and for use as septic tank absorption fields.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Spinks sand, 6 to 12 percent slopes, is one of several phases in the Spinks series.

Some map units are made up of two or more major soils. These map units are called soil complexes or undifferentiated groups.

A *soil complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Marlette-Owosso complex, 2 to 6 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Histosols and Aquents, ponded, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. These dissimilar soils are described in each map unit. Also, some of the more unusual or strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes some *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, gravel, is an example. Some miscellaneous areas are large enough to be delineated on the soil maps. Some that are too small to be delineated are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

11B—Boyer-Oshtemo sandy loams, 1 to 6 percent slopes. These are nearly level and undulating, well drained soils on broad, flat uplands and low knolls and ridges. The areas are irregular in shape and range from 3 to 500 or more acres. The Boyer soil makes up 40 to 55 percent of this complex, and the Oshtemo soil makes up 30 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Boyer soil has a surface layer that is dark brown sandy loam about 11 inches thick. The subsoil is dark brown and is about 23 inches thick. In the upper part it is friable sandy loam, and in the lower part it is friable gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous very gravelly sand. In some areas the subsoil contains more clay. In some areas the substratum is at a depth of less than 22 inches.

Typically, the Oshtemo soil has a surface layer that is dark brown sandy loam about 10 inches thick. The subsurface layer is yellowish brown sandy loam about 7 inches thick. The subsoil is about 33 inches thick. In the upper part it is strong brown, friable gravelly sandy loam, in the middle part it is yellowish red, firm gravelly sandy

clay loam; and in the lower part it is strong brown, loose sand and 1/8- to 1-inch-thick bands of dark brown very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, calcareous gravelly sand. In some areas 20 or more inches of sandy material is above the gravelly sandy loam and gravelly sandy clay loam parts of the subsoil. In some areas the subsoil contains more clay.

Included in mapping are small areas of well drained Spinks soils that have more sand in the subsoil than the Boyer and Oshtemo soils. These Spinks soils are scattered throughout the complex. Also included are small areas of somewhat poorly drained Brady soils in depressions and drainageways and on foot slopes. Also included are small areas of Leoni soils that have more pebbles and cobbles in the subsoil than the Boyer and Oshtemo soils. These Leoni soils are scattered throughout the complex. The included soils make up 5 to 15 percent of the complex.

Permeability is moderately rapid in the surface layer and the subsoil and very rapid in the substratum. The available water capacity is low for the Boyer soil and moderate for the Oshtemo soil. Surface runoff is slow.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as pasture, hayland, and woodland and for recreation uses and most kinds of building site development. They have fair potential for use as cropland and poor potential for use as sites for most kinds of sanitary facilities.

If these soils are cultivated, controlling soil blowing, maintaining a high content of organic matter, and conserving soil moisture during dry periods are major concerns of management. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. Irrigation should increase crop yields.

If these soils are used as pasture and hayland, the hazard of droughtiness is a major concern of management. In summer these soils often do not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry months. Overgrazing during the dry months can increase the hazard of soil blowing.

If these soils are used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable vegetation.

The use of these soils as septic tank absorption fields or as sites for sewage lagoons is limited by a hazard of ground water pollution. The soil material is too rapidly permeable to adequately filter the effluent from septic tank absorption fields and to prevent seepage from sewage lagoons. Filling or mounding the absorption field sites with suitable material increases the filtering capacity. Sealing the bottom and sides of sewage lagoons with impervious material can control seepage.

These soils have few limitations for building site development. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Lawns need a cover of loamy topsoil and need to be watered frequently to offset droughtiness. Cleared areas around construction sites should be protected from soil blowing by the use of mulch, asphalt spray, or netting or by grass seeding.

This complex is in capability subclass IIs and Michigan soil management groups 4a and 3a.

11C—Boyer-Oshtemo sandy loams, 6 to 12 percent slopes. These are rolling, well drained soils on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 3 to 160 or more acres. The Boyer soil makes up 40 to 55 percent of this complex, and the Oshtemo soil makes up 30 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Boyer soil has a surface layer that is dark brown sandy loam about 9 inches thick. The subsoil is dark brown and is about 23 inches thick. In the upper part it is friable sandy loam, and in the lower part it is friable gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous very gravelly sand. In some places, the subsoil contains more clay. In some areas the substratum is at a depth of less than 22 inches.

Typically, the Oshtemo soil has a surface layer that is dark brown sandy loam about 8 inches thick. The subsurface layer is yellowish brown sandy loam about 7 inches thick. The subsoil is about 33 inches thick. In the upper part it is strong brown, friable gravelly sandy loam; in the middle part it is yellowish red, firm gravelly sandy clay loam; and in the lower part it is strong brown, loose sand and 1/8- to 1-inch-thick bands of dark brown, very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, calcareous gravelly sand. In places, there is 20 or more inches of sandy material above the subsoil. In places, the subsoil contains more clay.

Included in mapping are small areas of well drained Spinks soils, which have more sand in the subsoil than the Boyer and Oshtemo soils. These Spinks soils are scattered throughout the complex and they make up about 5 percent of the complex. Also included are small areas of somewhat poorly drained Brady soils in depressions and drainageways and on foot slopes. These soils make up about 5 percent of the complex. Also included are small areas of Leoni soils that have more pebbles and cobbles in the subsoil than the Boyer and Oshtemo soils. These Leoni soils are scattered throughout the complex, and they make up about 5 percent of the complex.

Permeability is moderately rapid in the surface layer and the subsoil and very rapid in the substratum. The available water capacity is low for the Boyer soil and moderate for the Oshtemo soil. Surface runoff is medium.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as pasture, hayland, and woodland. They have fair potential for use as cropland and as sites for recreation and for most kinds of building site development. They have poor potential for use as septic tank absorption fields and as sites for sewage lagoons.

If these soils are cultivated, controlling soil blowing and water erosion, maintaining a high content of organic matter, and conserving soil moisture during dry periods are major concerns of management. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture.

The use of these soils as pasture or hayland is effective in controlling erosion. If these soils are used as pasture and hayland, the hazard of droughtiness is a major concern of management. In summer these soils often do not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing help to maintain production during the dry months. Overgrazing during the dry months can increase the hazard of soil blowing. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If these soils are planted to trees, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

The use of these soils as septic tank absorption fields is limited by the inadequate filtration capacity and the slope of the soils. Ground water pollution is a hazard. Filling or mounding the absorption field site with suitable material increases the filtering capacity of the soils. Installing the absorption field across the slope helps to overcome the slope limitation. These soils are generally not suited to use as sites for sewage lagoons because of the slope and a hazard of seepage.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Cleared areas around construction sites should be protected from soil erosion by the use of mulch, asphalt spray, or netting or by grass seeding.

This complex is in capability subclass IIIe and Michigan soil management groups 4a and 3a.

11D—Boyer-Oshtemo sandy loams, 12 to 18 percent slopes. These are hilly, well drained soils on hills, ridges, and knolls. The areas are irregular in shape and range from 3 to 50 or more acres. The Boyer soil makes up 40 to 55 percent of this complex, and the Oshtemo soil makes up 30 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Boyer soil has a surface layer that is dark brown sandy loam about 8 inches thick. The subsoil is dark brown and is about 20 inches thick. In the upper part it is friable sandy loam, and in the lower part it is dark brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous very gravelly sand. In some places, the subsoil contains more clay. In some areas the substratum is at a depth of less than 22 inches.

Typically, the Oshtemo soil has a surface layer that is dark brown sandy loam about 7 inches thick. The subsurface layer is yellowish brown sandy loam about 7 inches thick. The subsoil is about 29 inches thick. In the upper part it is strong brown, friable gravelly sandy loam; in the middle part it is yellowish red, firm gravelly sandy clay loam; and in the lower part it is strong brown, loose sand and 1/8- to 1-inch-thick bands of dark brown, very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, calcareous gravelly sand. In some places, there is 20 or more inches of sandy material above the subsoil. In some places, the subsoil contains more clay.

Included in mapping are small areas of well drained Spinks soils that have more sand in the subsoil than the Boyer and Oshtemo soils. These Spinks soils are scattered throughout the complex, and they make up about 5 percent of the complex. Also included are small areas of somewhat poorly drained Brady soils in depressions and drainageways and on foot slopes. These soils make up about 5 percent of the complex. Also included are small areas of Leoni soils that have more pebbles and cobbles in the subsoil than the Boyer and Oshtemo soils. These Leoni soils are scattered throughout the complex, and they make up about 5 percent of the complex.

Permeability is moderately rapid in the surface layer and the subsoil and very rapid in the substratum. The available water capacity is low for the Boyer soil and moderate for the Oshtemo soil. Surface runoff is rapid.

In most areas these soils are used as pasture. In a few areas they are used as woodland or cropland. These soils have good potential for use as pasture, hayland, and woodland. They have poor potential for use as cropland, for most recreation uses, for use as sites for sanitary facilities, and for building site development.

If these soils are cultivated, controlling soil blowing and water erosion, maintaining a high content of organic

matter, conserving soil moisture during dry periods, and overcoming equipment restrictions associated with slope are major concerns of management. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Cover crops, grassed waterways, and conservation tillage help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. Farming on the contour minimizes the equipment limitations associated with slope.

The use of these soils as pasture or hayland is effective in controlling erosion. If these soils are used as pasture and hayland, the hazard of droughtiness and equipment limitations associated with slope are major concerns of management. In summer these soils often do not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry months. Overgrazing during the dry months can increase the hazard of soil blowing. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion. Seeding and fertilizing on the contour minimizes the equipment limitations.

If these soils are planted to trees, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

The use of these soils as septic tank absorption fields is limited by the inadequate filtration capacity and the slope of the soils. Ground water pollution is a hazard. Filling or mounding the absorption field site with suitable material increases the filtering capacity of the soils. Installing the absorption field across the slope helps to overcome the slope limitation. These soils are generally not suited to use as sites for sewage lagoons because of the slope and the hazard of seepage.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Cleared areas around construction sites should be protected from soil erosion by the use of mulch, asphalt spray, or netting or by grass seeding.

This complex is in capability subclass IVe and Michigan soil management groups 4a and 3a.

11E—Boyer-Leoni complex, 18 to 40 percent slopes. These are steep and very steep, well drained soils on hills and along streams. The areas are irregular or long and narrow in shape and range from 3 to 60 or more acres. The Boyer soils make up 40 to 55 percent of this complex, and the Leoni soils make up 30 to 45 percent. The areas of these two soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Boyer soils have a surface layer of dark brown sandy loam about 7 inches thick. The subsoil is dark brown and is about 20 inches thick. In the upper part it is dark brown, friable sandy loam, and in the lower part it is dark brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous very gravelly sand. In some places, the subsoil contains more clay. In some areas the substratum is at a depth of less than 22 inches or more than 40 inches. Also in some areas the content of pebbles in the subsoil is greater than 25 percent.

Typically, the Leoni soils have a surface layer of dark brown gravelly sandy loam about 6 inches thick. The subsoil is dark brown and is about 35 inches thick. In the upper part it is firm cobbly sandy clay loam; in the middle part it is firm cobbly clay loam and gravelly clay loam, and in the lower part it is friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, calcareous gravelly loamy sand.

Included in mapping are small areas of well drained Hillsdale and Spinks soils on similar positions on the landscape. The Hillsdale soils have a loamy substratum and make up about 10 percent of the complex. The Spinks soils have less clay in the subsoil than the Boyer and Leoni soils and make up about 5 percent of the complex.

Permeability in the Boyer soils is moderately rapid in the surface layer and the subsoil and very rapid in the substratum. Permeability in the Leoni soils is moderate in the surface layer and the subsoil and moderately rapid or rapid in the substratum. The available water capacity is low. Surface runoff is very rapid.

In most areas these soils are used as woodland. In a few areas they are used as pasture. These soils have good potential for use as woodland and fair potential for use as pasture and hayland. They have poor potential for use as cropland, for recreation uses, for use as sites for sanitary facilities, and for building site development.

Crop production is generally not practical on these soils because of the steepness of slopes.

If these soils are used as woodland, erosion, equipment limitations, and plant competition are concerns of management. On the Leoni soils, seedling mortality is an additional hazard. The use of heavy equipment for planting, tending, and harvesting trees is restricted because of the steepness of slope. Constructing logging road and skid trails on the gentler slopes helps to overcome the equipment limitations and to prevent erosion. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs. Some seedling loss can be expected on the Leoni soils during the dry summer months. Stands can be improved by planting more seedlings than normal and by controlling plant competition.

These soils are generally not suitable for use as sites for sewage lagoons and for use as septic tank absorption fields because of the steepness of slope.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Cleared areas around construction sites should be protected from soil erosion by the use of mulch, asphalt spray, or netting or by grass seeding.

This complex is in capability subclass VIIe and Michigan soil management groups 4a and Ga.

13B—Ormas-Spinks complex, 0 to 6 percent slopes. These are nearly level and undulating, well drained soils on broad flat uplands and on low knolls and ridges. The areas are irregular in shape and range from 3 to 500 or more acres. The Ormas soils make up 40 to 50 percent of this complex, and the Spinks soils make up 30 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Ormas soils have a surface layer that is dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown loamy sand about 10 inches thick. The subsoil is about 24 inches thick. In the upper part it is dark brown, friable sandy loam and sandy clay loam, and in the lower part it is dark brown, very friable loamy sand and gravelly sandy loam. The substratum to a depth of about 60 inches is pale brown, calcareous gravelly sand. In some areas less than 20 inches of sandy material is above the subsoil.

Typically, the Spinks soils have a surface layer of dark brown sand about 6 inches thick. The subsurface layer, about 23 inches thick, is brownish yellow and light yellowish brown sand. Below that, to a depth of about 60 inches, is light yellowish brown, loose sand and bands, 1 inch to 5 inches thick, of dark brown, friable fine sand. In some areas the combined thickness of the bands is less than 6 inches.

Included in mapping are small areas of well drained Boyer and Oshtemo soils that have more clay in the surface layer and in the upper part of the subsoil than the Ormas and Spinks soils. These Boyer and Oshtemo soils are scattered throughout the complex, and they make up 5 to 15 percent of the complex. Also included are small areas of somewhat poorly drained Brady soils in depressions and drainageways and on foot slopes. They make up 5 to 10 percent of the complex.

Permeability in the Ormas soils is moderately rapid in the surface layer and the subsoil and very rapid in the substratum. Permeability in the Spinks soils is moderately rapid or rapid. The available water capacity is low. Surface runoff is slow.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as pasture, hayland, and woodland and most kinds of building site development. The Ormas soils have good potential for recreation uses, and the Spinks soils have poor potential. These soils have fair potential for use as cropland. They have poor potential for use as sites for most kinds of sanitary facilities.

If these soils are cultivated, controlling soil blowing, maintaining a high content of organic matter, and conserving soil moisture during dry periods are major concerns of management. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. Irrigation should increase crop yields.

If these soils are used as pasture and hayland, droughtiness is a major concern of management. In summer these soils often do not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry months. Overgrazing during the dry months increases the hazard of soil blowing.

If these soils are used as woodland, the hazard of seedling mortality is a concern of management. Plant competition also is a concern. Some seedling loss can be expected during the dry summer months. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. In new tree plantations, plant competition can be controlled by such practices as disking and the use of herbicides.

The use of these soils as septic tank absorption fields or as sites for sewage lagoons is limited by a hazard of ground water pollution. The soil material is too rapidly permeable to adequately filter the effluent from septic tank absorption fields and to prevent seepage from sewage lagoons. Filling or mounding absorption field sites with suitable material increases the filtering capacity. Sealing the bottom and sides of sewage lagoons with impervious material can control seepage.

These soils have few limitations for building site development. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Lawns need a cover of loamy topsoil and need to be watered frequently to offset droughtiness. Cleared areas around construction sites should be protected from soil blowing by the use of mulch, asphalt spray, or netting or by grass seeding.

This complex is in capability subclass IIIs and Michigan soil management group 4a.

13C—Ormas-Spinks complex, 6 to 12 percent slopes. These are rolling, well drained soils on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 3 to 160 or more acres. The Ormas soils make up 40 to 50 percent of this complex, and the Spinks soils make up 30 to 40 percent. The areas of these soils are so intricately mixed or so

small that it is not practical to separate them in mapping at the scale used.

Typically, the Ormas soils have a surface layer that is dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown loamy sand about 10 inches thick. The subsoil is about 24 inches thick. In the upper part it is dark brown, friable sandy loam and sandy clay loam, and in the lower part it is dark brown, very friable loamy sand and gravelly sandy loam. The substratum to a depth of about 60 inches is pale brown, calcareous gravelly sand. In some areas, less than 20 inches of sandy material is above the subsoil.

Typically, the Spinks soils have a surface layer that is dark brown sand about 6 inches thick. The subsurface layer is brownish yellow and light yellowish brown sand about 23 inches thick. Below that, to a depth of about 60 inches, is light yellowish brown, loose sand and bands, 1 inch to 5 inches thick, of dark brown, friable fine sand. In some places, the combined thickness of the bands is less than 6 inches.

Included in mapping are small areas of well drained Boyer and Oshtemo soils that have more clay in the surface layer and in the upper part of the subsoil than the Ormas and Spinks soils. These Boyer and Oshtemo soils are scattered throughout the complex, and they make up 5 to 15 percent of the complex. Also included are small areas of somewhat poorly drained Brady soils in depressions and drainageways and on foot slopes. They make up 5 to 10 percent of the complex.

Permeability in the Ormas soils is moderately rapid in the surface layer and the subsoil and very rapid in the substratum. Permeability in the Spinks soils is moderately rapid or rapid. The available water capacity is low. Surface runoff is medium.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as pasture, hayland, and woodland. They have fair potential for use as cropland and most kinds of building site development. They have poor potential for use as sites for most kinds of sanitary facilities. The Spinks soils have poor potential for recreation uses, and the Ormas soils have fair potential.

If these soils are cultivated, controlling soil blowing and water erosion, maintaining a high content of organic matter, and conserving soil moisture during dry periods are major concerns of management. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture.

The use of these soils as pasture or hayland is effective in controlling erosion. If these soils are used as pasture and hayland, droughtiness is a major concern of management. In summer these soils often do not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing help to maintain production during the dry months. Overgrazing during the dry months increases the hazard of soil blowing. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If these soils are used as woodland (fig. 8), the hazard of seedling mortality is a concern of management. Plant competition also is a concern. Some seedling loss can be expected during the dry summer months. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. Plant competition can be controlled by disking and by the use of herbicides.

If these soils are used as septic tank absorption fields, ground water pollution is a hazard. The Ormas soils are limited for this use because of slope, and the Spinks soils are limited because of inadequate filtration capacity and slope. Installing the absorption field across the slope helps to overcome the slope limitation. In areas of the Spinks soils, filling or mounding the absorption field sites with suitable material increases the filtering capacity. The Ormas and Spinks soils are generally not suited to use as sites for sewage lagoons because of the slope and the hazard of seepage.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Cleared areas around construction sites should be protected from soil blowing by the use of mulch, asphalt spray, or netting or by grass seeding.

This map unit is in capability subclass IIIs and Michigan soil management group 4a.

13D—Ormas-Spinks complex, 12 to 25 percent slopes. These are hilly, well drained soils on hills and high ridges and knolls and along streams. The areas are irregular in shape and range from 3 to 60 or more acres. The Ormas soils make up 40 to 50 percent of this complex, and the Spinks soils make up 30 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Ormas soils have a surface layer that is dark brown loamy sand about 10 inches thick. The subsurface layer is yellowish brown loamy sand about 10 inches thick. The subsoil is about 24 inches thick. In the upper part it is dark brown, friable sandy loam and sandy clay loam, and in the lower part it is dark brown, very friable loamy sand and gravelly sandy loam. The substratum to a depth of about 60 inches is pale brown, calcareous gravelly sand. In some areas less than 20 inches of sandy material is above the subsoil.

Figure 9.—These trees planted in an area of Ormas-Spinks complex, 6 to 12 percent slopes, serve as a windbreak, help to control erosion, and provide habitat for wildlife.

Typically, the Spinks soils have a surface layer that is dark brown sand about 6 inches thick. The subsurface layer is brownish yellow and light yellowish brown sand about 23 inches thick. Below that, to a depth of about 60 inches, is light yellowish brown, loose sand and bands 1 inch to 5 inches thick, of dark brown, friable fine sand. In some places the combined thickness of the bands is less than 6 inches.

Included in mapping are small areas of well drained Boyer and Oshtemo soils that have more clay in the surface layer and in the upper part of the subsoil than the Ormas and Spinks soils. These Boyer and Oshtemo soils are scattered throughout the complex, and they make up 5 to 15 percent of the complex. Also included are small areas of somewhat poorly drained Brady soils in depressions and drainageways and on foot slopes. They make up 5 to 10 percent of the complex.

Permeability in the Ormas soils is moderately rapid in the surface layer and the subsoil and very rapid in the substratum. Permeability in the Spinks soils is moderately rapid or rapid. The available water capacity is low. Surface runoff is medium.

In most areas these soils are used as pasture. In a few areas they are used as woodland or cropland. These soils have good potential for use as pasture, hayland and woodland. They have poor potential for use as cropland, for most recreation uses, for use as sites for sanitary facilities, and for building site development.

Crop production is usually not economically practical on these soils because of the steepness of slope.

The use of these soils as pasture or hayland is effective in controlling erosion. If these soils are used as pasture and hayland, the hazard of droughtiness and

equipment limitations associated with slope are major concerns of management. In summer, these soils often do not have sufficient moisture for optimum plant growth Rotation grazing or strip grazing helps to maintain production during the dry months. Overgrazing during the dry months increases the hazard of soil blowing. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion. Seeding and fertilizing on the contour minimize the equipment limitations.

If these soils are used as woodland, the hazard of seedling mortality is a concern of management. Plant competition also is a concern. Some seedling loss can be expected during the dry summer months. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. Plant competition can be controlled by disking and by the use of herbicides.

These soils are generally not suitable for use as sites for sewage lagoons and for use as septic tank absorption fields because of slope.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced Cleared areas around construction sites should be protected from soil erosion by the use of mulch, asphalt spray, or netting or by grass seeding.

This complex is in capability subclass VIe and Michigan soil management group 4a.

14B—Spinks sand, 0 to 6 percent slopes. This is a nearly level and undulating, well drained soil on broad, flat uplands and on low ridges and knolls. The areas are irregular in shape and range from 3 to 200 or more acres.

Typically, the surface layer is dark brown sand about 6 inches thick. The subsurface layer is brownish yellow and light yellowish brown sand about 23 inches thick. Below that, to a depth of about 60 inches, is light yellowish brown, loose sand and bands, 1 inch to 5 inches thick, of dark brown, friable fine sand. In some places, the bands are absent or have a combined thickness of less than 6 inches.

Included in mapping are small areas of well drained Ormas and Oshtemo soils that have more clay in the subsoil than the Spinks soil These soils are scattered throughout the map unit, and they make up about 5 to 15 percent of the unit. Also included are small areas of somewhat poorly drained Brady soils in depressions and drainageways and on foot slopes. They make up about 5 percent of the map unit.

Permeability is moderately rapid or rapid. The available water capacity is low. Surface runoff is slow.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as pasture, hayland, and woodland and most kinds of building site development It has fair potential for use as cropland. It has poor potential for use as a site for sewage lagoons, and for use as septic tank absorption fields, and for recreation uses.

If this soil is cultivated, controlling soil blowing, maintaining a high content of organic matter, and conserving soil moisture during dry periods are major concerns of management. Tree windbreaks, buffer strips cover crops, and conservation tillage help to control soil blowing. Returning crop residue to the soil and regularly adding other organic matter help to increase or maintain the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. Irrigation should increase crop yields.

If this soil is used as pasture and hayland, droughtiness is a major concern of management. In summer this soil often does not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry months. Overgrazing during the dry months increases the hazard of soil blowing.

If this soil is used as woodland, the hazard of seedling mortality is a concern of management. Some seedling loss can be expected during the dry summer months. But the loss can be offset by planting more seedlings than normal.

The use of this soil as septic tank absorption fields or as a site for sewage lagoons is limited by a hazard of ground water pollution. The soil material is too rapidly permeable to adequately filter the effluent from septic tank absorption fields and to prevent seepage from sewage lagoons. Filling or mounding the absorption field site with suitable material increases the filtering capacity. Sealing the bottom and sides of sewage lagoons with impervious material can control seepage.

This soil has few limitations for building site development The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Lawns need a cover of loamy topsoil and need to be watered frequently to offset droughtiness. Cleared areas around construction sites should be protected from soil blowing by the use of mulch, asphalt spray, or netting or by grass seeding.

This map unit is in capability subclass IIIs and Michigan soil management group 4a.

14C—Spinks sand, 6 to 12 percent slopes. This is a rolling, well drained soil on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 3 to 150 or more acres.

Typically, the surface layer is dark brown sand about 6 inches thick. The subsurface layer is brownish yellow and yellowish brown sand about 23 inches thick. Below that, to a depth of about 60 inches, is light yellowish brown, loose sand and bands, 1 inch to 5 inches thick,

of dark brown, friable fine sand. In some pedons the bands do not occur or have a combined thickness of less than 6 inches.

Included in mapping are small areas of well drained Ormas and Oshtemo soils that have more clay in the subsoil than the Spinks soil. These soils are scattered throughout the map unit, and they make up about 5 to 15 percent of the unit. Also included are small areas of somewhat poorly drained Brady soils in depressions and drainageways and on foot slopes. They make up about 5 percent of the map unit.

Permeability is moderately rapid or rapid. The available water capacity is low. Surface runoff is medium.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as pasture and woodland. It has fair potential for use as cropland and for building site development. It has poor potential for use as a site for sewage lagoons, and for use as septic tank absorption fields, and for recreation uses.

If this soil is cultivated, controlling soil blowing and water erosion, maintaining a high content of organic matter, and conserving soil moisture during dry periods are major concerns of management. Tree windbreaks, buffer strips, and cover crops help to control soil blowing. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture.

The use of this soil as pasture or hayland is effective in controlling erosion. If this soil is used as pasture and hayland, droughtiness is a major concern of management. In summer this soil often does not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry months. Overgrazing during the dry months increases the hazard of soil blowing. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If this soil is used as woodland, the hazard of seedling mortality is a concern of management. Some seedling loss can be expected during the dry summer months. But the loss can be offset by planting more seedlings than normal.

The use of this soil as septic tank absorption fields is limited by inadequate filtration capacity and the slope of the soil. Ground water pollution is a hazard. Filling or mounding the absorption field site with suitable material increases the filtering capacity of this soil. Installing the absorption field across the slope helps to overcome the slope limitation. This soil is generally not suited to use as a site for sewage lagoons because of the slope and the hazard of seepage.

The use of this soil for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Lawns need a cover of loamy topsoil and need to be watered frequently to offset droughtiness. Cleared areas around construction sites should be protected from soil blowing by the use of mulch, asphalt spray, or netting or by grass seeding.

This map unit is in capability subclass IIIe and Michigan soil management group 4a.

14D—Spinks sand, 12 to 25 percent slopes. This is a hilly and steep, well drained soil on hills and high ridges and knolls. The areas are irregular in shape and range from 3 to 100 or more acres.

Typically, the surface layer is dark brown sand about 6 inches thick. The subsurface layer is brownish yellow and light yellowish brown sand about 23 inches thick. Below that, to a depth of about 60 inches, is light yellowish brown, loose sand and bands, 1 inch to 5 inches thick, of dark brown, friable fine sand. In some places the bands are absent or have a combined thickness of less than 6 inches.

Included in mapping are small areas of well drained Ormas and Oshtemo soils that have more clay in the subsoil than the Spinks soil. These soils are scattered throughout the map unit, and they make up about 5 to 15 percent of the unit. Also included are small areas of somewhat poorly drained Brady soils in depressions and drainageways and on foot slopes. They make up about 5 percent of the map unit.

Permeability is moderately rapid or rapid. The available water capacity is low. Surface runoff is rapid.

In most areas this soil is used as pasture. In a few areas it is used as woodland or cropland. This soil has good potential for use as pasture, hayland, and woodland. It has poor potential for use as cropland, for most recreation uses, for use as a site for sanitary facilities, and for building site development.

Crop production is usually not economically practical on this soil because of the steepness of slope.

The use of this soil as pasture or hayland is effective in controlling erosion. If this soil is used as pasture and hayland, the hazards of droughtiness and water erosion are major concerns of management. Equipment limitations associated with slope are also of major concern. In summer, this soil often does not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry months. Overgrazing during the dry months increases the hazard of soil blowing. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion. Seeding and fertilizing on the contour minimize equipment limitations.

If this soil is used as woodland, the hazard of seedling mortality is a concern of management. Some seedling loss can be expected during the dry summer months. Stands can be improved by planting more seedlings than

normal. On the steeper slopes, erosion is a hazard and the use of heavy equipment for planting, tending, and harvesting trees is restricted. Constructing logging roads and skid trails on the gentler slopes helps to prevent erosion and to overcome the equipment limitations.

This soil is generally not suitable for use as a site for sewage lagoons and for use as septic tank absorption fields because of the steepness of slope.

The use of this soil for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Cleared areas around construction sites should be protected from soil erosion by the use of mulch, asphalt spray, or netting or by grass seeding.

This map unit is in capability subclass VIe and Michigan soil management group 4a.

15A—Teasdale fine sandy loam, 0 to 3 percent slopes. This is a nearly level and gently sloping, somewhat poorly drained soil in broad, flat areas, on low knolls and ridges at the base of slopes, along drainageways, and in shallow depressions. The areas of this map unit are irregular or elongated in shape and range from 3 to 100 or more acres.

Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. The subsurface layer is yellowish brown, mottled fine sandy loam about 4 inches thick. The subsoil is brown, dark brown, and dark yellowish brown, mottled, friable fine sandy loam about 42 inches thick. The substratum to a depth of about 65 inches is yellowish brown, mottled, calcareous fine sandy loam. In some areas the substratum consists of sand and gravel or stratified silt loam and fine sand. Also, in some areas the substratum is at a depth of less than 40 inches.

Included in mapping are small areas of poorly drained Barry soils in depressions and drainageways. These soils make up about 5 to 10 percent of the map unit. Also included are small areas of well drained Hillsdale and Riddles soils on the top of knolls and ridges. These soils make up about 5 to 10 percent of the map unit.

Permeability is moderate. The available water capacity is moderate. Surface runoff is slow. The high water table is at a depth of 1/2 foot to 1 1/2 feet from November to May.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. It has good potential for use as cropland, pasture and hayland, and woodland. It has poor potential for most recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water during wet periods, maintaining a high content of organic matter, and maintaining good soil tilth are major concerns of management. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil. Working this soil when it is wet may result in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

If this soil is used as pasture and hayland, wetness and surface compaction are the major concerns of management. Overgrazing or grazing when the soil is wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, plant competition is a moderate concern of management. Intensive site preparation and herbicides help to control the growth of undesirable vegetation.

The use of this soil as septic tank absorption fields, as a site for sewage lagoons, and for building site development is limited by the seasonal high water table. Conventional septic tank absorption fields generally are not practical in this soil. The soil can be used as a site for buildings without basements if suitable fill material is used to raise the site and if a subsurface drainage system is installed. Frost action is an additional limitation to the use of this soil for use as a site for local roads and streets. This limitation can be offset by replacing or covering the upper layer of this soil with suitable base material. The included Hillsdale and Riddles soils are better suited to building site development because they are better drained.

This map unit is in capability subclass IIw and Michigan soil management group 3b.

16A—Brady sandy loam, 0 to 3 percent slopes. This is a nearly level and gently sloping, somewhat poorly drained soil in broad, flat areas, on low ridges and knolls, on foot slopes, along drainageways, and in shallow depressions. The areas are irregular in shape and range from 3 to 100 or more acres in size.

Typically, the surface layer is dark yellowish brown sandy loam about 10 inches thick. The subsurface layer is brown sandy loam about 3 inches thick. The subsoil is yellowish brown and mottled and is about 41 inches thick. In the upper part it is friable sandy loam, and in the lower part it is very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, mottled calcareous sand. In some areas, the surface layer is darker. In some places the subsoil contains more clay, and in some places it contains stratified layers of sand and loamy sand.

Included in mapping are small areas of very poorly drained Gilford soils in depressional areas. These soils make up about 5 to 10 percent of the map unit. Also included are small areas of well drained Boyer, Oshtemo, and Spinks soils. These soils are on ridgetops and knolls, and they make up about 5 to 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. The available water capacity is moderate. Surface runoff is slow. The high water table is at a depth of 1 to 3 feet from November to May.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as cropland, pasture, and hayland. It has fair potential for use as woodland. It has poor potential for most recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water during wet periods, controlling soil blowing, and maintaining a high content of organic matter and good tilth are major concerns of management. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Open ditches are difficult to maintain and tile is difficult to install because cutbanks cave in. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Working this soil when it is wet may result in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

If this soil is used as pasture and hayland, wetness and surface compaction are the major concerns of management. Overgrazing or grazing when this soil is wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, plant competition is a moderate concern of management. Intensive site preparation and herbicides help to control the growth of undesirable vegetation.

The use of this soil as septic tank absorption fields and as a site for buildings is limited by the seasonal high water table. Conventional septic tank absorption fields generally are not practical in this soil. The soil can be used as a site for buildings without basements if suitable well compacted fill material is used to raise the site and if a subsurface drainage system is installed. Frost action is a limitation to the use of this soil as a site for local roads and streets. This limitation can be offset by replacing or covering the upper layer of this soil with suitable base material. The included Boyer, Oshtemo, and Spinks soils are better suited to building site development because they are better drained.

This map unit is in capability subclass IIw and Michigan soil management group 3b.

17—Barry loam. This is a nearly level, poorly drained soil in broad, flat areas and in depressions and drainageways. It is subject to frequent ponding. The areas of this map unit are irregular or elongated in shape and range from 3 to 100 or more acres.

Typically, the surface layer is black loam about 10 inches thick. The subsoil is mottled and is about 20 inches thick. In the upper part it is dark olive gray, friable loam; in the middle part it is dark gray and olive, firm and friable sandy clay loam; and in the lower part it is olive, very friable sandy loam. The substratum to a depth of about 60 inches is grayish brown and calcareous. It is sandy loam in the upper 14 inches and loamy sand in the lower 16 inches. In some places, the surface layer is less than 10 inches thick. In some places, the subsoil contains less clay. Also in some places, the substratum is stratified sandy, loamy, and silty material or sand and gravelly sand.

Included in mapping are small areas of somewhat poorly drained Teasdale soils on low knolls and ridges. These soils make up 10 to 15 percent of the map unit. Also included are small areas of very poorly drained Palms soil that are on slightly lower positions on the landscape and make up about 5 percent of the map unit.

Permeability is moderate. The available water capacity is high. Surface runoff is slow. This soil has a high water table near or above the surface from November to May.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as cropland, pasture, and hayland. It has fair potential for use as woodland. It has poor potential for recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water, providing adequate drainage outlets, and maintaining good soil tilth are major concerns of management. Artificial drainage is needed for optimum crop yields. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Lift pumps may be needed at the outlet in some areas. Working this soil when it is wet results in compaction and the formation of clods. Conservation tillage, cover crops, crop residue returned to the soil, and regular additions of other organic matter help to maintain good soil tilth.

If this soil is used as pasture and hayland, excess water and surface compaction are the major concerns of management. Pasture plants that are tolerant of wetness should be selected. Overgrazing or grazing this soil when

it is wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, equipment limitations and plant competition are major concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted during wet periods. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs. The hazards of seedling mortality and windthrow also are concerns of management. Seedling loss may be high because of wetness. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. To minimize windthrow damage, stands should be thinned only slightly; mature stands can be clear cut.

This soil is generally not suited to use as septic tank absorption fields, to use as a site for sewage lagoons, and to building site development because of the hazard of ponding.

This map unit is in capability subclass IIw and Michigan soil management group 3c.

18—Gilford-Colwood complex. This complex consists of nearly level, very poorly drained Gilford soils and poorly drained Colwood soils in broad flat areas and in depressions and drainageways. These soils are subject to frequent ponding. The areas of this complex are irregular or elongated in shape and range from 3 to 200 or more acres. The Gilford soils make up 40 to 55 percent of this complex, and the Colwood soils make up 30 to 45 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Gilford soils have a surface layer that is black fine sandy loam about 11 inches thick. The subsoil is grayish brown and mottled and is about 24 inches thick. In the upper part it is friable fine sandy loam; in the middle part it is friable loam; and in the lower part it is stratified grayish brown, very friable fine sandy loam and yellowish brown, loose loamy sand. The substratum to a depth of about 60 inches is mottled and consists of stratified grayish brown sandy loam, loamy sand, and sand in the upper 15 inches and light olive brown, calcareous sand in the lower 10 inches. In some places the subsoil contains more clay. In some places, the substratum is at a depth of more than 40 inches.

Typically, in the Colwood soil the surface and subsurface layers combined are about 12 inches thick. The surface layer is very dark gray silt loam, and the subsurface layer is very dark gray, mottled very fine sandy loam. The subsoil is mottled and is about 21 inches thick. In the upper part it is dark grayish brown, friable very fine sandy loam; in the middle part it is light olive brown, friable loam; and in the lower part it is stratified olive and brownish yellow, friable loamy fine sand, loamy very fine sand, fine sandy loam, and firm clay loam. The substratum to a depth of about 60 inches is stratified gray and light olive brown, mottled, calcareous fine sand, loamy fine sand, silt loam, and silty clay loam. In some places the substratum is sand or gravelly sand.

Included in mapping are small areas of somewhat poorly drained Dixboro and Kibbie soils on low knolls and ridges. They make up 5 to 10 percent of the map unit. Also included are small areas of very poorly drained Henrietta soils that have a surface layer of muck. They are on slightly lower positions on the landscape than the Gilford and Colwood soils, and they make up 5 to 10 percent of the map unit.

Permeability in the Gilford soils is moderately rapid in the subsoil and rapid in the substratum. Permeability in the Colwood soils is moderate. The available water capacity is moderate for the Gilford soils and high for the Colwood soils. Surface runoff is very slow or ponded. These soils have a seasonal high water table near or above the surface from December to May.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as cropland, pasture, and hayland. They have poor potential for woodland use, for recreation uses, for use as sites for sanitary facilities, and for building site development.

If these soils are cultivated, removing excess water, providing adequate drainage outlets, and maintaining good soil tilth are major concerns of management. Controlling soil blowing is an additional concern on the Gilford soils. Artificial drainage is needed for optimum crop yields. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Open ditches are difficult to maintain and tile is difficult to install because cutbanks cave. Tile lines should be protected with a suitable material to prevent their filling with fine sand. Lift pumps may be needed at the outlet in some areas. Tree windbreaks, buffer strips, and conservation tillage help to control soil blowing on the Gilford soils. Working these soils when they are wet results in compaction and the formation of clods. Conservation tillage, cover crops, crop residue returned to the soil, and regular additions of other organic matter help to maintain good soil tilth.

If these soils are used as pasture and hayland, excess water and surface compaction are the major concerns of management. Pasture plant species that are tolerant of wetness should be selected. Overgrazing or grazing when these soils are too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If these soils are used as woodland, equipment limitations and plant competition are major concerns of

management. The use of heavy equipment for planting tending, and harvesting trees is restricted during the wet periods. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs. The hazards of seedling mortality and windthrow also are concerns of management. Seedling loss may be high because of wetness. But the loss can be offset by planting more seedlings than normal and by controlling plant competition To minimize windthrow damage, stands should be thinned only slightly; mature stands can be clear cut.

These soils are generally not suited to use as septic tank absorption fields, to use as sites for sewage lagoons, and to building site development because of the hazard of ponding.

This complex is in capability subclass IIw and Michigan soil management groups 4c and 2.5c-s.

20—Houghton muck. This is a nearly level, very poorly drained soil in bogs, depressions, and drainageways and along the edge of lakes. This soil is subject to frequent ponding The areas are irregular in shape and range from 3 to 500 or more acres

Typically, the surface layer is black muck about 10 inches thick. The underlying layers to a depth of about 60 inches are black muck. In some places, there is more than 1 inch of sedimentary peat within 51 inches of the surface. In some places, there is more than 10 inches of mucky peat within 51 inches of the surface. In some areas sandy or loamy deposits are at a depth of less than 51 inches.

Included in mapping are small areas of very poorly drained Edwards soils that are on similar positions on the landscape. These soils have a marly substratum at a depth of 16 to 50 inches, and they make up about 5 percent of the map unit.

Permeability is moderately slow to moderately rapid The available water capacity is high. Surface runoff is very slow or ponded The high water table is near or above the surface from September to June. This soil is often low in some micronutrients

In most areas this soil has a cover of natural vegetation, including trees. In drained areas it is generally used for truck and specialty crops. This soil has good potential for use as pasture and hayland. It also has good potential for truck and specialty crops. It has fair potential for woodland use. It has poor potential for recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water preventing ponding, providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and overcoming equipment limitations associated with soil stability are major concerns of management Frost action is a hazard in some areas. This soil may be deficient in nutrients, especially micronutrients, needed for some crops. Artificial drainage is needed. Lift pumps may be needed at the drainage outlet in some areas. If this soil is drained, soil blowing is a hazard. Tree windbreaks, buffer strips, and cover crops help to control the soil blowing. Controlled drainage improves soil stability and reduces subsidence. This soil needs to be tested for nutrient deficiencies Fertilizer may be needed

If this soil is used as pasture and hayland excess water and surface compaction are the major concerns of management. Grazing when this soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, equipment limitations and plant competition are major concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted because of wetness and the low stability of the soil material. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs. The severe hazards of seedling mortality and windthrow also are concerns of management. Seedling losses may be high because of wetness. But this loss can be offset by planting more seedlings than normal and by controlling plant competition. To minimize windthrow damage, intermediate and regeneration cuts should be carefully planned to give maximum protection from the wind.

This soil is not suited to use as a site for sanitary facilities or to building site development because of the high water table, the hazard of ponding, and the instability of the soil material. These limitations are extremely difficult to overcome

This map unit is in capability subclass IIIw and Michigan soil management group Mc.

22—Cohoctah fine sandy loam. This is a nearly level, poorly drained soil on flood plains of rivers and streams. It is frequently flooded by stream overflow for brief periods each year. The areas are irregular or elongated in shape and range from 3 to 300 or more acres.

Typically, the surface and subsurface layers are black and very dark grayish brown, mottled fine sandy loam and, combined, are about 11 inches thick. The substratum to a depth of about 60 inches is stratified, mottled, multicolored very fine sandy loam, fine sandy loam, silt loam, and sand. In some areas, the surface layer is muck. In some places, the surface layer and the upper part of the substratum are not mottled In some areas the substratum contains more clay.

Included in mapping are small areas of very poorly drained Gilford soils and poorly drained Colwood soils on similar positions on the landscape. These soils make up 5 to 10 percent of the map unit. Also included are small areas of very poorly drained Palms soils. These soils are on abandoned stream and river channels and make up about 10 percent of the map unit.

Permeability is moderately rapid. The available water capacity is moderate. Surface runoff is very slow or

ponded. This soil has a high water table 1 foot or less below the surface from September to May.

In most areas this soil is used as woodland or wetland. In few areas it is used as pasture. It has fair potential for use as woodland. It has poor potential for use as cropland, pasture, and hayland, for recreation uses, for use as a site for sanitary facilities, and for building site development.

Crop production is usually not economically practical on this soil because of the frequent flooding. If this soil is cultivated, removing excess water, preventing flooding, controlling soil blowing, maintaining good soil tilth, and overcoming equipment limitations associated with wetness are major concerns of management. Frost action is a hazard in some areas.

If this soil is used as pasture and hayland, excess water and surface compaction are the major concerns of management. Only pasture plant species that are tolerant of wetness should be selected. Overgrazing or grazing when this soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, equipment limitations and plant competition are major concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted because of wetness and flooding. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs. The hazard of seedling mortality and windthrow also are concerns of management. Seedling loss may be high because of the wetness and flooding. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. To minimize windthrow damage, intermediate and regeneration cuts should be carefully planned to give maximum protection from the wind.

This soil is not suited to use as a site for sanitary facilities or to building site development because of the high water table and the hazard of flooding. These limitations are extremely difficult to overcome.

This map unit is in capability subclass Vw and Michigan soil management group L-2c.

29A—Kibbie fine sandy loam, 0 to 3 percent slopes. This is a nearly level and gently sloping, somewhat poorly drained soil in broad flat areas, on low knolls and ridges, on foot slopes, and along drainageways. The areas of this map unit are irregular in shape and range from 3 to 40 or more acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 9 inches thick. The subsoil is mottled and is about 26 inches thick. In the upper part it is yellowish brown, firm clay loam; in the middle part it is light olive brown, friable fine sandy loam; and in the lower part it is light olive brown, friable sandy loam and loamy fine sand. The substratum to a depth of about 60 inches is stratified brown and light olive brown, mottled, calcareous very fine sandy loam, fine sand, and silt loam. In some places, the surface layer is darker. In some areas the subsoil contains less clay.

Included in mapping are small areas of very poorly drained Gilford soils and poorly drained Colwood soils in depressions and drainageways. These included soils make up 5 to 15 percent of the map unit.

Permeability is moderate. The available water capacity is high. Surface runoff is slow. This soil has a high water table at a depth of 1 to 2 feet from November to May.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as cropland, pasture, hayland, and woodland. It has fair potential for recreation uses. It has poor potential for use as a site for sanitary facilities and for building site development.

If this soil is cultivated, removing excess water during wet periods and maintaining a high content of organic matter and good soil tilth are major concerns of management. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Open ditches are difficult to maintain, and tile is difficult to install because cutbanks cave in. Tile lines should be protected with a suitable material to prevent their filling with fine sand. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Working the soil when it is too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

If this soil is used as pasture and hayland, excess water during wet periods and surface compaction are the major concerns of management. Overgrazing or grazing when this soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable vegetation.

The use of this soil as septic tank absorption fields and as a site for sewage lagoons or buildings is limited by the seasonal high water table. Conventional septic tank absorption fields generally are not practical in this soil. The soil can be used as a site for buildings without basements if suitable well compacted fill material is used to raise the site and if a subsurface drainage system is installed. Frost action is a limitation to the use of this soil as a site for local roads and streets. This limitation can be offset by replacing or covering the upper layer of this soil with suitable base material.

This map unit is in capability subclass IIw and Michigan soil management group 2.5b-s.

30—Edwards muck. This is a nearly level, very poorly drained soil in bogs, depressions, and drainageways and along the edge of lakes. This soil is subject to frequent ponding. The areas are irregular in shape and range from 3 to 80 acres or more.

Typically, the upper layer is black muck about 28 inches thick. The substratum to a depth of about 60 inches is light gray and gray marl. In some places the muck is less than 16 inches thick.

Included in mapping are small areas of very poorly drained Houghton and Palms soils. The Houghton soils have more than 51 inches of organic material, and the Palms soils have a loamy substratum. These included soils are scattered throughout the map unit, and they make up 10 to 20 percent of the unit.

Permeability is moderately slow to moderately rapid in the organic layer. The available water capacity is high. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface from September to June. It has a high pH and may, therefore be deficient in some of the micronutrients needed by certain crops.

In most areas this soil has a cover of natural vegetation, including trees. In some areas it is drained, generally for truck and specialty crops. In a few areas it is used as pasture. This soil has good potential for truck and specialty crops and for pasture and hay crops. It has poor potential for woodland use, for recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water, preventing ponding, providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and overcoming equipment limitations associated with soil stability are major concerns of management. Frost action is a hazard in some areas. Artificial drainage is needed. Lift pumps may be needed at the drainage outlet in some areas. If this soil is drained, soil blowing is a hazard. Tree windbreaks, buffer strips, and cover crops help to control the soil blowing. Controlled drainage improves soil stability and reduces subsidence. This soil needs to be tested for nutrient deficiencies. Fertilizer may be needed.

If this soil is used as pasture and hayland, removing excess water and preventing surface compaction are major concerns of management. Artificial drainage is needed if this soil is used as pasture. Grazing when this soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

Commercial wood production is generally not economically practical on this soil. Trees grow slowly because of the high water table. In many areas, only shrubs grow. The use of heavy equipment for planting, tending, and harvesting trees is severely restricted because of the wetness and the low stability of the soil material. Plant competition, seedling mortality, and windthrow are severe hazards.

This soil is not suited to use as a site for sanitary facilities and to building site development because of the high water table, the hazard of ponding, and the instability of the soil material. These limitations are extremely difficult to overcome.

This map unit is in capability subclass IVw and Michigan soil management group M/mc.

35B—Arkport-Okee loamy fine sands, 2 to 6 percent slopes. These are undulating, well drained soils on broad, nearly flat uplands and on low knolls and ridges. The areas are irregular in shape and range from 3 to 300 or more acres. The Arkport soils make up 30 to 45 percent of this complex, and the Okee soils make up 30 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Arkport soils have a surface layer that is dark brown loamy fine sand about 8 inches thick. The subsurface layer is about 54 inches thick. It consists of yellowish brown, loose loamy fine sand and bands, 1/8 inch to 6 inches thick, of strong brown, friable fine sandy loam. The substratum to a depth of about 66 inches is stratified calcareous, yellowish brown fine sand and very fine sand. In some areas the bands are sand or loamy sand.

Typically, the Okee soils have a surface layer that is dark brown loamy fine sand about 8 inches thick. The subsurface layer, about 16 inches thick, is yellowish brown loamy fine sand. The subsoil is about 34 inches thick. In the upper part it is yellowish brown, friable sandy loam, and in the lower part it is dark brown, very friable loamy sand. The substratum to a depth of about 66 inches is yellowish brown, calcareous sandy loam. In some areas there is less than 20 inches of loamy fine sand above the subsoil. In some areas the subsoil contains more clay. In some areas the substratum is sand and gravel.

Included in mapping are small areas of well drained Boyer and Oshtemo soils that have more clay in the surface layer and in the upper part of the subsoil than the Arkport and Okee soils. These Boyer and Oshtemo soils are scattered throughout the complex, and they make up 5 to 10 percent of the complex. Also included are small areas of somewhat poorly drained Dixboro soils in depressions and drainageways and on foot slopes. These soils make up about 5 to 10 percent of the complex.

Permeability in the Arkport soils is moderately rapid. Permeability in the Okee soils is moderately rapid in the surface and subsurface layers and moderate in the subsoil and the substratum. The available water capacity is low for Arkport soils and moderate for Okee soils. Surface runoff is slow.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as pasture, hayland, woodland, and septic tank absorption fields and for most kinds of building site development uses. They have fair potential for use as cropland and for recreation uses. They have poor potential for use as sites for sewage lagoons.

If these soils are cultivated, controlling soil blowing, maintaining a high content of organic matter, and conserving soil moisture during dry periods are major concerns of management. A hazard of erosion is an additional concern on the Arkport soil. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. Irrigation should increase crop yields. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion on the Arkport soil.

If these soils are used as pasture and hayland, the hazard of droughtiness is a major concern of management. In summer these soils often do not have sufficient moisture for optimum plant growth. Deep-rooted, drought-resistant plant species should, therefore, be selected. Rotation grazing or strip grazing helps to maintain production during the dry periods. Overgrazing during the dry periods can increase the hazard of soil blowing.

If these soils are used as woodland, plant competition and seedling mortality are concerns of management. Intensive site preparation and herbicides help to control the growth of unwanted trees and shrubs.

If these soils are used as sites for sewage lagoons, seepage of the effluent, resulting in the pollution of ground water, is a hazard. Sealing the bottom and sides of the lagoons with impervious material can control seepage.

These soils have few limitations for building site development. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Cleared areas around construction sites should be protected from soil blowing by the use of mulch, asphalt spray, or netting or by grass seeding.

This complex is in capability subclass IIe and Michigan soil management groups 3a-s and 4/2a.

35C—Arkport-Okee loamy fine sands, 6 to 12 percent slopes. These are rolling, well drained soils on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 3 to 150 or more acres. The Arkport soils make up 30 to 45 percent of this complex, and the Okee soils make up 30 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Arkport soils have a surface layer that is dark brown loamy fine sand about 7 inches thick. The subsurface layer is about 54 inches thick. It consists of yellowish brown, loose loamy fine sand and bands, 1/8 inch to 6 inches thick, of strong brown, friable fine sandy loam. The substratum to a depth of about 65 inches is stratified, yellowish brown, calcareous fine sand and very fine sand. In some areas the bands are sand or loamy sand.

Typically, the Okee soils have a surface layer that is dark brown loamy fine sand about 7 inches thick. The subsurface layer, about 16 inches thick, is yellowish brown loamy fine sand. The subsoil is about 34 inches thick. In the upper part it is yellowish brown, very friable loamy fine sand; in the middle part it is yellowish brown, friable sandy loam, and in the lower part it is dark brown, very friable loamy sand. The substratum to a depth of about 66 inches is yellowish brown, calcareous sandy loam. In some areas there is less than 20 inches of loamy fine sand above the subsoil. In some places, the subsoil contains more clay. In some areas the substratum consists of sand and gravel.

Included in mapping are small areas of well drained Boyer and Oshtemo soils that have more clay in the surface soil and in the upper part of the subsoil than the Arkport and Okee soils. These Boyer and Oshtemo soils are scattered throughout the complex, and they make up 5 to 10 percent of the complex. Also included are small areas of somewhat poorly drained Dixboro soils in depressions and drainageways and on foot slopes. These soils make up about 5 percent of the complex.

Permeability in the Arkport soils is moderately rapid. Permeability in the Okee soils is moderately rapid in the surface and subsurface layers and moderate in the subsoil and the substratum. The available water capacity is low for Arkport soils and moderate for Okee soils. Surface runoff is medium.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as pasture, hayland, and woodland. They have fair potential for use as cropland, for most recreation uses, for use as septic tank absorption fields, and for most kinds of building site development uses. They have poor potential for use as sites for sewage lagoons.

If these soils are cultivated, controlling soil blowing and water erosion, maintaining a high content of organic matter, and conserving soil moisture during dry periods are major concerns of management. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture.

If these soils are used as pasture and hayland, the hazards of droughtiness and water erosion are major concerns of management. In summer these soils often do not have sufficient moisture for optimum plant growth. Deep-rooted, drought-resistant plant species should, therefore, be selected. Rotation grazing or strip grazing helps to maintain production during the dry periods. Overgrazing during the dry periods increases the hazard of soil blowing. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If these soils are used as woodland, plant competition and seedling mortality are concerns of management. Intensive site preparation and herbicides help to control the growth of undesirable vegetation.

The use of these soils as septic tank absorption fields is limited by slope. Ground water pollution is a hazard. Filling or mounding the absorption field site with suitable material increases the filtering capacity of the soils. Installing the absorption field across the slope helps to overcome the slope limitation. These soils are generally not suited to use as sites for sewage lagoons because of the slope and a hazard of seepage.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Lawns need a cover of loamy topsoil and need to be watered frequently to offset droughtiness. Cleared areas around construction sites should be protected from soil erosion by the use of mulch, asphalt spray, or netting or by grass seeding.

This complex is in capability subclass IIIe and Michigan soil management groups 3a-s and 4/2a.

35D—Arkport-Okee loamy fine sands, 12 to 25 percent slopes. These are hilly and steep, well drained soils on hills and high ridges and knolls. The areas are irregular in shape and range from 3 to 75 or more acres. The Arkport soils make up 30 to 45 percent of this complex, and the Okee soils make up 30 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Arkport soils have a surface layer that is dark brown loamy fine sand about 6 inches thick. The subsurface layer is about 50 inches thick. It consists of yellowish brown, loose loamy fine sand and bands, 1/8 inch to 6 inches thick, of strong brown, friable fine sandy loam. The substratum to a depth of 66 inches is stratified, yellowish brown, calcareous fine sand and very fine sand. In some places, the bands are sand or loamy sand.

Typically, the Okee soils have a surface layer that is dark brown loamy fine sand about 6 inches thick. The subsurface layer, about 16 inches thick, is yellowish brown loamy fine sand. The subsoil is about 34 inches thick. In the upper part it is yellowish brown, very friable loamy sand, in the middle part it is yellowish brown, friable sandy loam; and in the lower part it is dark brown very friable loamy sand. The substratum to a depth of about 66 inches is yellowish brown, calcareous sandy loam. In some areas there is less than 20 inches of loamy fine sand above the subsoil. In some places, the substratum consists of sand and gravel. In some places, the subsoil contains more clay.

Included in mapping are small areas of well drained Boyer and Oshtemo soils, which have more clay in the surface soil and in upper part of the subsoil than the Arkport and Okee soils. These Boyer and Oshtemo soils are scattered throughout the complex, and they make up 5 to 10 percent of the complex. Also included are small areas of somewhat poorly drained Dixboro soils in depressions and drainageways and on foot slopes. These soils make up about 5 percent of the complex.

Permeability in the Arkport soils is moderately rapid. Permeability in the Okee soils is moderately rapid in the surface and subsurface layers and moderate in the subsoil and the substratum. The available water capacity is low for the Arkport soils and moderate for the Okee soils. Surface runoff is rapid.

In most areas these soils are used as pasture. In a few areas they are used as woodland or cropland. In some places these soils are used as a source of sand. These soils have good potential for use as pasture, hayland, and woodland. They have poor potential for use as cropland, for recreation uses, for use as sites for sanitary facilities, and for building site development.

If these soils are cultivated, controlling soil blowing and water erosion, maintaining a high content of organic matter, conserving soil moisture during dry periods, and overcoming equipment limitations associated with slope are major concerns of management. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the surface and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. Farming on the contour minimizes the equipment limitations associated with slope.

If these soils are used as pasture and hayland, the hazards of droughtiness and water erosion and the equipment limitations associated with slope are major concerns of management. In summer these soils often do not have sufficient moisture for optimum plant growth. Deep-rooted, drought-resistant plant species should, therefore, be selected. Rotation grazing or strip grazing helps to maintain production during the dry periods. Overgrazing during the dry periods increases the hazard of soil blowing. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface

runoff and erosion. Seeding and fertilizing on the contour minimize the equipment limitations.

If these soils are used as woodland, plant competition and equipment limitations are the major concerns of management. Plant competition is a severe problem on the Okee soil. The use of heavy equipment for planting, tending, and harvesting trees is restricted because of the steepness of slope. Some seedling loss can be expected during the dry summer months. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. Plant competition can be controlled on the Okee soil with practices such as disking and application of herbicides. Constructing logging roads and skid trails on gentle slopes helps control erosion and overcome equipment limitations.

These soils are generally not suitable for use as sites for sewage lagoons and for use as septic tank absorption fields because of the steepness of slope.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Cleared areas around construction sites should be protected from soil erosion by the use of mulch, asphalt spray, or netting or by grass seeding.

This complex is in capability subclass IVe and Michigan soil management groups 3a-s and 4/2a.

37—Palms muck. This is a nearly level, very poorly drained soil in bogs, depressions, and drainageways and along the edges of lakes. This soil is subject to frequent ponding. The areas are irregular or circular in shape and range from 3 to 200 or more acres.

Typically, the upper layer is black muck about 32 inches thick. The substratum to a depth of 60 inches is mottled. It is grayish brown and brown sandy loam in the upper 14 inches and grayish brown loamy sand in the lower 14 inches. In some areas the muck is less than 16 inches thick, and in some areas it is greater than 51 inches thick. In some areas the substratum is sandy. In some areas more than 2 inches of sedimentary peat is within 51 inches of the surface.

Included in mapping are small areas of poorly drained Barry and Colwood soils and very poorly drained Gilford soils that do not have an organic layer. These soils are on slightly higher positions on the landscape, and they make up 5 to 10 percent of the map unit. Also included are small areas of very poorly drained Edwards soil. These soils have a marly substratum and make up about 5 percent of the map unit.

Permeability is moderately slow to moderately rapid in the organic layer and moderate in the substratum. The available water capacity is high. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface from November to May. This soil is often low in some micronutrients.

In most areas this soil has a cover of natural vegetation, including trees. In some areas it is drained, generally for truck and specialty crops. In a few areas it is used as pasture. This soil has good potential for truck and specialty crops and for pasture and hay crops. It has poor potential for use as habitat for woodland wildlife, for recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water, preventing flooding, providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and overcoming equipment limitations associated with soil stability are major concerns of management. Frost action is a hazard in some areas. Artificial drainage is needed. Lift pumps may be needed at the drainage outlet in some areas. If this soil is drained, soil blowing is a hazard. Tree windbreaks, buffer strips, and cover crops help to control soil blowing. Controlled drainage improves soil stability and reduces subsidence. This soil needs to be tested for nutrient deficiencies. Fertilizer may be needed.

If this soil is used as pasture and hayland, excess water and surface compaction are the major concerns of management. Grazing when the soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, equipment limitations and plant competition are major concerns of management. The use of heavy equipment for planting, tending, and haresting trees is restricted because of wetness. Intensive site preparation and herbicides help to control plant competition. The severe hazards of seedling mortality and windthrow also are concerns of management. Seedling loss may be high because of the wetness. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. To minimize windthrow damage, intermediate and regeneration cuts should be carefully planned to give maximum protection from the wind.

This soil is not suited to use as a site for sanitary facilities and to building site development because of the high water table, the hazard of ponding, and the instability of the soil material. These limitations are extremely difficult to overcome.

This map unit is in capability subclass IIIw and Michigan soil management group M/3c.

39A—Ypsi-Wauseon complex, 0 to 3 percent slopes. This complex consists of nearly level and undulating, somewhat poorly drained Ypsi soils and nearly level, very poorly drained Wauseon soils. The Ypsi soils are on low knolls and ridges and along drainageways. The Wauseon soils are in broad, flat areas and in depressions and drainageways. The Wauseon soils are subject to ponding. The areas of this complex are irregular in shape and range from 3 to 80 or

more acres. The Ypsi soils make up 40 to 60 percent of this complex, and the Wauseon soils make up 20 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Ypsi soils have a surface layer that is very dark gray sandy loam about 8 inches thick. The subsoil is mottled and is about 21 inches thick. In the upper part it is dark grayish brown and yellowish brown, friable sandy loam; in the lower part it is yellowish brown, very friable gravelly sandy loam. The substratum to a depth of about 60 inches is brown, mottled, stratified, calcareous silty clay and silty clay loam. In some areas the subsoil contains more clay. In some places, the subsoil is not mottled. In some areas the substratum is at a depth greater than 40 inches. In some places, the substratum is loamy.

Typically, the Wauseon soils have a surface layer that is black loam about 13 inches thick. This surface layer is mottled in the lower part. The subsoil is mottled and is about 23 inches thick. In the upper part it is grayish brown, friable sandy loam; in the lower part it is gray, very friable gravelly sandy loam. The substratum to a depth of about 60 inches is gray, mottled, stratified, calcareous silty clay and silty clay loam. In some areas the subsoil contains more clay. In some areas the substratum is at a depth greater than 36 inches. In some areas the substratum is loamy or sandy.

Included in mapping are small areas of poorly drained Cohoctah soils and very poorly drained Palms soils that are on slightly lower positions on the landscape than the Wauseon soils. The Cohoctah soils are subject to flooding, and the Palms soils have organic horizons 16 to 51 inches thick. They make up 5 to 15 percent of the complex.

Permeability in the Ypsi soils is moderately rapid in the surface layer and the subsoil and slow in the substratum. Permeability in the Wauseon soils is rapid in the surface layer and the subsoil and very slow in the substratum. The available water capacity is moderate for the Ypsi soils and high for the Wauseon soils. Surface runoff is slow on the Ypsi soils and very slow or ponded on the Wauseon soils. The Ypsi soils have a perched water table 1 to 2 feet below the surface from November to May. The Wauseon soils have a perched water table near or above the surface from January to April.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as cropland, pasture, hayland, and woodland. They have poor potential for use as septic tank absorption fields, for use as sites for sewage lagoons, and for building site development. The Ypsi soils have fair potential for recreation uses, and the Wauseon soils have poor potential.

If these soils are cultivated, removing excess water, providing adequate drainage outlets, controlling soil blowing, and maintaining good tilth are major concerns of management. Artificial drainage is needed for optimum crop yields. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Lift pumps may be needed at the outlet in some areas. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Working these soils when they are too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

If these soils are used as pasture and hayland, excess water and preventing surface compaction are major concerns of management. Overgrazing or grazing when these soils are too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If these soils are used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs. On the Wauseon soils, seedling mortality, equipment limitations, and windthrow are additional concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted during wet periods. Seedling loss may be high on the Wauseon soils because of the wetness. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. To minimize windthrow damage on the Wauseon soils, intermediate and regeneration cuts should be carefully planned to give maximum protection from the wind.

The use of these soils as septic tank absorption fields, as sites for sewage lagoons, and for building site development is limited by the high water table. The use of these soils as septic tank absorption fields is limited also by the slow permeability of the substratum. The soils are generally not suited to use as conventional septic tank absorption fields, to use as sites for sewage lagoons, or to building site development. The Ypsi soils can be used as sites for buildings without basements if suitable fill material is used to raise the site and if a subsurface draiange system is installed. Frost action is a limitation to the use of these soils as sites for local roads and streets. This limitation can be offset by replacing or covering the upper layer of the soils with a suitable base material.

This complex is in capability subclass IIw and Michigan soil management groups 3/1b and 3/1c.

40—Lenawee silt loam. This is a nearly level, poorly drained soil in broad, flat areas and in depressions and drainageways. This soil is subject to frequent ponding. The areas of this map unit are irregular in shape and range from 3 to 160 or more acres.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsoil is mottled and

is about 29 inches thick. In the upper part it is grayish brown, firm silty clay loam; and in the lower part it is gray silty clay loam and thin strata of very fine sand and silt loam. The substratum to a depth of about 60 inches is yellowish brown mottled, stratified, calcareous silt loam, silty clay loam, and very fine sand. In some areas the surface layer is greater than 10 inches thick. In some areas the subsoil contains less clay. Also, in some areas the substratum is sand, gravelly sand, or sandy loam and loamy sand.

Included in mapping are small areas of somewhat poorly drained Del Rey soils on low knolls and ridges. These soils make up from 10 to 15 percent of the map unit. Also included are small areas of very poorly drained Palms soils that have organic horizons 16 to 51 inches thick. These soils are on slightly lower positions on the landscape than the Lenawee soil, and they make up about 5 percent of the map unit.

Permeability is moderately slow. The available water capacity is high. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface from January to May.

In most areas this soil is used as woodland. In a few areas it is used as pasture or cropland. This soil has good potential for use as cropland, pasture, hayland, and woodland. It has poor potential for recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water, providing adequate drainage outlets, and maintaining good soil tilth are major concerns of management. The hazard of ponding is also a concern in some areas. Artificial drainage is needed for optimum crop yields. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Lift pumps may be needed at the outlet in some areas. Working this soil when it is too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

If this soil is used as pasture and hayland, excess water and surface compaction are the major concerns of management. Ponding is a hazard in some areas. Pasture plant species that are tolerant of wetness should be selected. Overgrazing or grazing when this soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, equipment limitations and plant competition are major concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted during wet periods. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs. The hazards of seedling mortality and windthrow also are concerns of management. Seedling loss may be high because of the wetness. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. To minimize windthrow damage, intermediate and harvest cuts should be carefully planned to give maximum protection from the wind.

This soil is generally not suited to use as septic tank absorption fields, to use as a site for sewage lagoons, and to building site development because of the hazard of ponding.

This map unit is in capability subclass IIIw and Michigan soil management group 1.5c.

42A—Riddles sandy loam, 0 to 2 percent slopes. This is a nearly level, well drained soil on broad, flat uplands. The areas are irregular in shape and range from 3 to 100 or more acres.

Typically, the surface layer is dark brown sandy loam about 9 inches thick. The subsurface layer is yellowish brown sandy loam about 4 inches thick. The subsoil is about 41 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam, in the middle part it is dark yellowish brown, friable sandy clay loam; and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some areas the subsoil contains less clay. In some areas the substratum is at a depth of less than 40 inches, and in some areas the substratum is gravelly sand. In some places, the surface layer is loamy sand.

Included in mapping are small areas of somewhat poorly drained Teasdale soils in depressions and drainageways. These soils make up about 5 to 10 percent of the map unit. Also included are small areas of well drained Arkport and Okee soils that have more sand in the subsoil than the Riddles soil. These soils are scattered throughout the map unit, and they make up about 5 percent of the unit.

Permeability is moderate. The available water capacity is moderate. Surface runoff is slow.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as cropland, pasture, hayland, woodland, for recreation uses, and for use as septic tank absorption fields. It has fair potential for use as a site for sewage lagoons and for building site development.

If this soil is cultivated, maintaining a high content of organic matter and good soil tilth are major concerns of management. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Working this soil when it is too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

If this soil is used as woodland, plant competition is a concern of management. Intensive site preparation and

herbicides help to control the growth of undesirable trees and shrubs.

This soil is suited to use as septic tank absorption fields. The use of this soil as a site for sewage lagoons is limited by the hazard of seepage. Sealing the bottom and sides of sewage lagoons with impervious material can control the seepage.

The use of this soil for building site development is limited by the shrinking and swelling of the soil. Replacing the upper layers of the soil with suitable material can control the shrinking and swelling.

This map unit is in capability class I and Michigan soil management group 2.5a.

42B—Riddles sandy loam, 2 to 6 percent slopes. This is an undulating, well drained soil on broad, nearly flat uplands and on low ridges and knolls. The areas are irregular in shape and range from 3 to 100 or more acres.

Typically, the surface layer is dark brown sandy loam about 9 inches thick. The subsurface layer is yellowish brown sandy loam about 4 inches thick. The subsoil is about 41 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam; in the middle part it is dark yellowish brown, firm sandy clay loam, and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some places the subsoil contains less clay. In some areas the substratum is at a depth of less than 40 inches, and in some areas it is gravelly sand. In some areas the surface layer is loamy sand.

Included in mapping are small areas of somewhat poorly drained Teasdale soils in depressions and drainageways. These soils make up about 5 to 10 percent of the map unit. Also included are small areas of well drained Arkport and Okee soils that have more sand in the subsoil than the Riddles soil. These soils are scattered throughout the map unit, and they make up about 5 percent of the unit. Also included are small areas of well drained Leoni soils that have more pebbles and cobbles in the subsoil than the Riddles soil. These soils are scattered throughout the map unit, and they make up about 5 percent of the unit.

Permeability is moderate. The available water capacity is moderate. Surface runoff is slow.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as cropland, pasture, hayland, and woodland, for most recreation uses, and for use as septic tank absorption fields. It has fair potential for use as a site for sewage lagoons and for building site development.

If this soil is cultivated, maintaining a high content of organic matter, controlling water erosion, and maintaining good soil tilth are major concerns of management. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Cover crops, grassed waterways, and conservation tillage used in a tillage crop rotation help to control surface runoff and erosion. Working this soil when it is too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

The use of this soil as pasture or hayland is effective in controlling erosion. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If this soil is used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

This soil is suited to use as septic tank absorption fields. The use of this soil as a site for sewage lagoons is limited by slope and the hazard of seepage. Landshaping helps to overcome the slope limitation. Sealing the bottom and sides of sewage lagoons with impervious material can control the seepage.

The use of this soil for building site development is limited by the shrinking and swelling of the soil. Replacing the upper layers of the soil with suitable material can control the shrinking and swelling.

This map unit is in capability subclass IIe and Michigan soil management group 2.5a.

42C—Riddles sandy loam, 6 to 12 percent slopes. This is a rolling, well drained soil on broad uplands and on ridges and knolls. The areas are irregular in shape and range from 3 to 60 or more acres.

Typically, the surface layer is dark brown sandy loam about 8 inches thick. The subsurface layer is yellowish brown sandy loam about 4 inches thick. The subsoil is about 39 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam; in the middle part it is dark yellowish brown, friable sandy clay loam; and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some places the subsoil contains less clay. In some areas the substratum is at a depth of less than 40 inches, and in some areas it is gravelly sand. In some areas the surface layer is loam.

Included in mapping are small areas of somewhat poorly drained Teasdale soils in depressions and drainageways. These soils make up about 5 to 10 percent of the map unit. Also included are small areas of well drained Arkport and Okee soils that have more sand in the subsoil than the Riddles soil. These soils are scattered throughout the map unit, and they make up 5 percent of the unit. Also included are small areas of Leoni soils that have more pebbles and cobbles in the subsoil than the Riddles soil. These soils are scattered throughout the map unit and make up about 5 percent of the unit.

Permeability is moderate. The available water capacity is moderate. Surface runoff is medium.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as pasture, hayland, and woodland. It has fair potential for use as cropland, for most recreation uses, for use as septic tank absorption fields, and for most kinds of building site development. It has poor potential for use as a site for sewage lagoons.

If this soil is cultivated, maintaining a high content of organic matter, controlling water erosion, and maintaining good soil tilth are major concerns of management. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Cover crops, grassed waterways (fig. 9), and conservation tillage used in a crop rotation help to control surface runoff and erosion. Working this soil when it is too wet results in compaction and formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

The use of this soil as pasture or hayland is effective in controlling erosion. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If this soil is used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

The use of this soil as a site for septic tank absorption fields is limited by slope. Installing the absorption field across the slope helps offset this limitation. This soil is generally not suited to use as a site for sewage lagoons because of slope.

The use of this soil for building site development is limited by the shrinking and swelling of the subsoil and by slope. The shrinking and swelling can be overcome by replacing the subsoil material with more suitable material. For buildings, the slope limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. Cleared areas around construction sites should be

Figure 9.—The grassed waterway in this area of Riddles sandy loam, 6 to 12 percent slopes, helps to control erosion.

protected from erosion by the use of mulch, asphalt spray, or netting or by grass seeding

This map unit is in capability subclass IIIe and Michigan soil management group 2.5a.

42D—Riddles sandy loam, 12 to 18 percent slopes. This is a hilly, well drained soil on ridges and high knolls. The areas are irregular in shape and range from 3 to 60 or more acres.

Typically, the surface layer is dark brown sandy loam about 7 inches thick. The subsurface layer is yellowish brown sandy loam about 3 inches thick. The subsoil is about 37 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam, in the middle part it is dark yellowish brown, friable sandy clay loam; and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some places the subsoil contains less clay. In some areas the substratum is at a depth of less than 40 inches, and in some areas it is gravelly sand.

Included in mapping are small areas of somewhat poorly drained Teasdale soils in depressions and drainageways. These soils make up about 5 to 10 percent of the map unit. Also included are small areas of well drained Arkport and Okee soils that have more sand in the subsoil than the Riddles soil. These soils are scattered throughout the map unit, and they make up about 5 percent of the unit. Also included are small areas of Leoni soils that have more pebbles and cobbles in the subsoil than the Riddles soil. These soils are scattered throughout the map unit, and they make up about 5 percent of the unit.

Permeability is moderate. The available water capacity is moderate. Surface runoff is rapid.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as pasture, hayland, and woodland. It has fair potential for use as cropland. It has poor potential for most recreation uses, for use as a site for sanitary facilities, and for most kinds of building site development.

If this soil is cultivated, maintaining a high content of organic matter, controlling water erosion, maintaining good soil tilth, and overcoming equipment limitations associated with slope are major concerns of management. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Working this soil when it is too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth. Farming on the contour minimizes the equipment limitations associated with slope.

The use of this soil as pasture or hayland is effective in controlling erosion. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If this soil is used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of unwanted trees and shrubs.

This soil is generally not suitable for use as a site for sewage lagoons and for use as septic tank absorption fields because of slope.

The use of this soil for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. Cleared areas around construction sites should be protected from soil erosion by the use of mulch, asphalt spray, or netting or by grass seeding.

This map unit is in capability subclass IVe and Michigan soil management group 2.5a.

43A—Dixboro very fine sandy loam, 0 to 3 percent slopes. This is a nearly level and gently sloping, somewhat poorly drained soil in broad flat areas, on low knolls and ridges, on foot slopes, and along drainageways. The areas of this map unit are irregular in shape and range from 3 to 100 or more acres.

Typically, the surface layer is dark brown very fine sandy loam about 9 inches thick. The subsurface layer, about 8 inches thick, is light yellowish brown mottled very fine sandy loam. The subsoil is mottled and is about 44 inches thick. In the upper part it is yellowish brown, friable very fine sandy loam; in the next part it is strong brown, friable silt loam; in the next part it is dark yellowish brown, friable sandy loam, and in the lower part is dark yellowish brown, very friable loamy sand. The substratum to a depth of about 66 inches is stratified, light yellowish brown and brown, calcareous silt loam and very fine sand. In some areas, the surface layer is darker. In some areas the subsoil has more clay, and in some areas it has strata of sandy material. In some areas the substratum is at a depth of less than 44 inches.

Included in mapping are small areas of well drained Arkport soils that are on slightly higher positions on the landscape than the Dixboro soil. These soils make up about 5 percent of the map unit. Also included are small areas of poorly drained Colwood soils in depressions and drainageways. These soils make up 5 to 10 percent of the map unit.

Permeability is moderate. The available water capacity is high. Surface runoff is slow. This soil has a high water table 1 to 2 feet below the surface from November to April.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as cropland, pasture, hayland, and

wood and. It has poor potential for most recreation uses, for use as a site for sanitary facilit.es and for building site development.

If this soil is cultivated, removing excess water during wet periods, controlling so l blowing, and maintaining a high content of organic matter and good soil ti th are major concerns of management. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natura drainageways. Open ditches are difficult to maintain and tile is difficult to install because cutbanks cave in. T le lines should be protected with a suitable material to prevent their filling with fine sand Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing Returning crop res due to the soi and regularly adding other organic matter help to maintain or increase the content of organic matter Working this soil when it is too wet may result in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

If this soil is used as pasture and hayland, excess water and surface compaction are the major concerns of management. Overgrazing or grazing on this soil when it is too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition

f th s soil is used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of unwanted trees and shrubs.

The use of th s soil as septic tank absorpt on fields and as a site for sewage lagoons or buildings s limited by the seasonal high water table. Conventional sept c tank absorption fields generally are not practical in this soil. The soil can be used as a site for buildings without basements if suitab e fill material is used to raise the site and if a subsurface drainage system is installed. The walls of trenches tend to cave in and, therefore, need to be re nforced Frost action is a limitation to the use of this soi as a site for loca roads and streets. This limitation can be offset by replacing or covering the upper layer of this soil with suitable base materia

This map is in capability subclass IIw and M chigan soil management group 3b-s.

44B—Leoni gravelly sandy loam, 2 to 6 percent slopes. This is an undulating well drained soil on broad, nearly leve uplands and on low ridges and knolls. The areas are irregular in shape and range from 3 to 300 or more acres.

Typically, the surface layer is very dark grayish brown gravelly sandy loam about 11 inches thick. The subsurface layer is brown gravelly sandy loam about 2 inches thick. The subsoil is dark brown and is about 29 inches thick. n the upper part It is firm gravelly sandy clay loam, and in the lower part it s firm and friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, calcareous very gravelly loamy sand.

Included in mapping are small areas of somewhat poorly drained Brady soils in depressions and drainageways. These soi s make up about 5 percent of the map unit. Also nc uded are small areas of well drained Ormas soils that have fewer cobbles and pebbles and more sand in the subsoil than the Leoni soil. These soils are scattered throughout the map unit, and they make up about 5 percent of the unit.

Permeability is moderate n the surface layer and the subsoil and rapid or moderately rapid in the substratum The available water capacity is low. Surface runoff is slow

In most areas this soi is used as cropland. In a few areas it is used as pasture or woodland. This soil has a good potential for use as pasture hay and, and woodland. It has fair potential for use as cropland, for most recreation uses, and for most kinds of building site development. It has poor potential for use as a site for sewage lagoons and for use as septic tank absorption fields.

If this soil is cultivated, mainta ning the content of organic matter, conserving soil moisture during dry periods, and overcoming equipment limitations associated with the high cobble content are ma,or concerns of management. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to ncrease the available water capacity of the soil. Conservation tillage helps to increase soil moisture. Irrigation should increase crop yields n most areas there are enough cobbles n the surface ayer to make seedbed preparation and harvesting difficult. If the cobbles are removed, crop yields should improve and equipment wear should decrease

If this soil is used as pasture and hayland, the hazard of droughtness is the major concern of management In summer this soil often does not have sufficient moisture for optimum plant growth Rotation grazing or strip grazing helps to ma ntain production during the dry periods.

If this soil is used as a site for sewage lagoons, seepage of the effluent, resulting in the po lution of ground water, is a hazard. Sealing the bottom and sides of the lagoon with mpervious material can control seepage.

The use of this soil for building site development is limited by large stones and by the shrinking and swelling of the soil The large stones may need to be removed from some sites. The shrinking and swelling can be contro led by replac ng the upper layers of this soi with suitable material The walls of shallow excavations tend to cave in and, therefore, need to be reinforced.

This map unit is in capability subclass IIs and Michigan soil management group Ga

44C—Leoni gravelly sandy loam, 6 to 12 percent slopes. This is a rolling, well drained soil on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 3 to 100 or more acres.

Typically, the surface layer is very dark grayish brown gravelly sandy loam about 11 inches thick. The subsurface layer is brown gravelly sandy loam about 2 inches thick. The subsoil is dark brown and is about 29 inches thick. In the upper part it is firm gravelly sandy clay loam and in the lower part it is friable and firm gravelly sandy loam in which the content of cobblestones is about 10 percent. The substratum to a depth of about 60 inches is dark yellowish brown, calcareous very gravelly loamy sand. In some areas the subsoil is less than 35 percent pebbles and cobbles.

Included in mapping are small areas of somewhat poorly drained Brady soils in depressions and drainageways. These soils make up about 5 percent of the map unit. Also included are small areas of well drained Ormas soils that have fewer pebbles and cobbles and more sand in the subsoil than the Leoni soil. These soils are scattered throughout the map unit, and they make up about 5 percent of the unit.

Permeability is moderate in the surface layer and the subsoil and rapid or moderately rapid in the substratum. The available water capacity is low. Surface runoff is medium.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as pasture, hayland, and woodland. It has fair potential for use as cropland, for most recreation uses, and for most kinds of building site development. It has poor potential for use as a site for sewage lagoons and for use as septic tank absorption fields.

If this soil is cultivated, controlling water erosion, maintaining the content of organic matter, conserving soil moisture during dry periods, and overcoming equipment limitations associated with the high cobble content are the major concerns of management. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. In most areas there are enough cobbles in the surface layer to make seedbed preparation and harvesting difficult. If the cobbles are removed, crop yields should improve and equipment wear should decrease.

The use of this soil as pasture or hayland is effective in controlling erosion. If this soil is used as pasture and hayland, the hazard of droughtiness is a major concern of management. In summer this soil often does not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry periods. Maintaining an adequate vegetative cover by preventing overgrazing helps to control erosion.

The use of this soil as septic tank absorption fields is limited by slope. Installing the absorption field across the slope helps to overcome this limitation. This soil is generally not suited to use as a site for sewage lagoons because of slope.

The use of this soil for building site development is limited by large stones, by the shrinking and swelling of the soil, and by slope. The large stones may need to be removed from some sites. The shrinking and swelling can be controlled by replacing the upper layers of the soil with suitable material. For buildings, the slope limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced.

This map unit is in capability subclass IIIe and Michigan soil management group Ga.

44D—Leoni gravelly sandy loam, 12 to 18 percent slopes. This is a hilly, well drained soil on ridges and high knolls. The areas are irregular in shape and range from 3 to 100 or more acres.

Typically, the surface layer is very dark grayish brown gravelly sandy loam about 11 inches thick. The subsurface layer is brown gravelly sandy loam about 2 inches thick. The subsoil is dark brown and is about 29 inches thick. In the upper part it is firm gravelly sandy clay loam, and in the lower part it is firm and friable gravelly sandy loam in which the content of cobblestones is about 10 percent. The substratum to a depth of about 60 inches is dark yellowish brown, calcareous very gravelly loamy sand. In some areas the subsoil is less than 35 percent pebbles and cobbles.

Included in mapping are small areas of Ormas and Spinks soils that have fewer pebbles and cobbles and more sand in the subsoil than the Leoni soil. These soils are scattered throughout the map unit, and they make up about 10 percent of the unit.

Permeability is moderate in the surface layer and the subsoil and rapid or moderately rapid in the substratum. The available water capacity is low. Surface runoff is rapid.

In most areas this soil is used as pasture. In a few areas it is used as cropland or woodland. This soil has good potential for use as pasture, hayland, and woodland. It has poor potential for use as cropland, for recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, controlling water erosion, maintaining the content of organic matter, conserving soil moisture during dry periods, and overcoming

equipment limitations associated with slope and the high cobble content are concerns of management. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture.

The use of this soil as pasture or hayland is effective in controlling erosion. If this soil is used as pasture and hayland, the hazard of droughtiness is a major concern of management. Equipment limitations associated with slope are also a major concern. In summer this soil often does not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry periods. Maintaining an adequate vegetative cover by preventing overgrazing helps to control erosion. Seeding and fertilizing on the contour minimize the equipment limitations.

This soil is generally not suitable for use as a site for sewage lagoons and for use as septic tank absorption fields because of slope.

The use of this soil for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Cleared areas around construction sites should be protected from soil erosion by the use of mulch, asphalt spray, or netting or by grass seeding.

This map unit is in capability subclass IVe and Michigan soil management group Ga.

45—Martisco muck. This is a nearly level, very poorly drained soil in bogs, depressions, and drainageways and along the edges of lakes. This soil is subject to frequent ponding. The areas are irregular in shape and range from 3 to 100 or more acres.

Typically, the surface layer is black muck about 8 inches thick. The substratum to a depth of about 60 inches is mottled, white and gray marl. In some areas the mucky surface layer is less than 8 inches thick, and in some areas it is more than 16 inches thick. In some areas the substratum is loamy or sandy material.

Included in mapping are small areas of very poorly drained Palms and Houghton soils. These soils have thicker organic layers than the Martisco soil and do not have a marly substratum. They are scattered throughout the map unit, and they make up about 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the organic material and slow in the substratum. The available water capacity is high. Surface runoff is very slow or ponded. This soil has a high water table at or above the surface from October to June. It has a high pH and may, therefore, be deficient in some of the micronutrients needed by certain crops.

In most areas this soil has a cover of natural vegetation, including trees. In some areas the soil is drained, generally for truck and specialty crops. In a few areas it is used as pasture. This soil has good potential for truck and specialty crops and for pasture and hay crops. It has poor potential for woodland use, for recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water, preventing ponding, providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and overcoming equipment limitations associated with soil stability are major concerns of management. Frost action is a hazard in some areas. Artificial drainage is needed for crop production. Lift pumps may be needed at the drainage outlet in some areas. If this soil is drained, soil blowing is a hazard. Tree windbreaks, buffer strips, and cover crops help to control soil blowing. Controlled drainage improves soil stability and reduces subsidence. This soil needs to be tested for nutrient deficiencies. Fertilization may be needed.

If this soil is used as pasture and hayland, excess water and surface compaction are the major concerns of management. Grazing when the soil is too wet will cause surface compaction and destroy forage plants. Proper stocking rates and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

Commercial wood production is generally not economically practical on this soil. Trees grow slowly because of the high water table. In many areas only shrubs grow. The use of heavy equipment for planting, tending, and harvesting trees is severely restricted because of the wetness. Plant competition, seedling mortality, and windthrow are severe hazards.

This soil is not suited to use as a site for sanitary facilities and to building site development because of the high water table, the hazard of ponding, and the instability of the soil material. These limitations are extremely difficult to overcome.

This map unit is in capability subclass IVw and Michigan soil management group M/mc.

46—Sebewa loam. This is a nearly level, poorly drained soil in broad, flat areas and in depressions and drainageways. This soil is subject to frequent ponding. The areas of this map unit are irregular in shape and range from 3 to 100 or more acres.

Typically, the surface and subsurface layers are black loam and very dark gray loam and, combined, are about 15 inches thick. The subsoil is mottled and is about 20 inches thick. In the upper part it is dark gray and gray, firm clay loam; in the lower part it is gray, friable sandy loam. The substratum to a depth of about 60 inches is gray and light brownish gray, calcareous sand. In some places the subsoil contains less clay. In some areas the

substratum is stratified sandy, loamy, and silty material or is loamy throughout.

Included in mapping are small areas of somewhat poorly drained Brady soils on low ridges and knolls. These soils make up about 5 to 10 percent of the map unit. Also included are small areas of very poorly drained Henrietta soils that have a surface layer of muck. These soils are on slightly lower positions on the landscape than the Sebewa soil, and they make up about 5 percent of the map unit.

Permeability is moderate in the surface and subsurface layers and the subsoil and rapid in the substratum. The available water capacity is moderate. Surface runoff is very slow or ponded. This soil has a high water table at or above the surface from September to May.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as cropland, pasture, hayland, and woodland. It has poor potential for recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water, providing adequate drainage outlets, and maintaining good soil tilth are major concerns of management. The hazard of ponding is a concern in some areas. Artificial drainage is needed for optimum crop yields. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Lift pumps may be needed at the outlet in some areas. Working this soil when it is too wet results in compaction and formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

If this soil is used as pasture and hayland, excess water and surface compaction are the major concerns of management. Ponding is a hazard in some areas. Pasture plant species that are tolerant of wetness should be selected. Overgrazing or grazing when this soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, equipment limitations and plant competition are major concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted during wet periods. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs. The hazards of seedling mortality and windthrow also are concerns of management. Seedling loss may be high because of the wetness. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. To minimize windthrow damage, intermediate and regeneration cuts should be carefully planned to give maximum protection from the wind.

This soil generally is not suited to use as septic tank absorption fields, to use as a site for sewage lagoons, and to building site development because of the hazard of ponding.

This map unit is in capability subclass IIw and Michigan soil management group 3/5c.

47—Histosols and Aquents, ponded. This map unit consists of nearly level, very poorly drained organic soils and very poorly drained sandy or loamy soils. These soils are in marsh areas, most of which are always flooded. The areas are irregular or circular in shape and range from 3 to 250 or more acres. The Histosols make up 60 to 80 percent of this map unit, and the Aquents make up 0 to 30 percent.

These soils vary greatly in some important properties, especially texture.

Included in mapping are small areas of open water that make up 5 to 10 percent of the map unit. Also included are small areas of very poorly drained Martisco and Henrietta soils. These soils make up 5 to 10 percent of the map unit.

Most areas of these soils are marshland. These soils have good potential for use as habitat for wetland wildlife. They have poor potential for use as cropland, pasture, hayland, and woodland, for recreation uses, for building site development, and for use as sites for sanitary facilities.

This map unit is in capability subclass VIIIw. It is not assigned to a Michigan soil management group.

48—Napoleon muck. This is a nearly level, very poorly drained soil in bogs and depressions. This soil is subject to frequent ponding. The areas are irregular or circular in shape and range from 3 to 100 or more acres.

Typically, the surface and subsurface layers are black and dark brown muck that have a combined thickness of about 10 inches. The underlying material to a depth of about 60 inches is dark brown mucky peat. This soil is extremely acid throughout. In some areas more than 2 inches of sedimentary peat is within 51 inches of the surface. In some areas the organic layers are less than 51 inches thick. In some places, the underlying material includes more than 10 inches of muck. In some places the pH is greater than 4.5.

Included in mapping are small areas of very poorly drained Gilford soils that do not have organic layers and are less acid than Napoleon muck. These soils are on slightly higher positions, along the edge of the map unit, and they make up about 5 percent of the unit. Also included are small areas of very poorly drained Houghton and Palms soils that have organic layers that are less acid. These soils are scattered throughout the map unit, and they make up about 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid. The available water capacity is very high. Surface runoff is very slow or ponded. This soil has a high water table

near or above the surface from September to June. The low pH of this organic soil may cause a deficiency of some micronutrients in certain crops.

In most areas this soil has a cover of natural vegetation, including trees. General cultivated crops are seldom grown because of the wetness and high acidity of the soil. Usually, it is not economically practical to overcome these limitations. Specialty crops such as blueberries and cranberries, however, are commonly grown in a few areas that have been drained. This soil has good potential for truck and specialty crops. It has fair potential for use as pasture and hayland. It has poor potential for woodland use, for recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is used as pasture and hayland, excess water and surface compaction are the major concerns of management. Grazing when the soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, equipment limitations and plant competition are major concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted because of the wetness and the stability of the soil material. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs. The severe hazards of seedling mortality and windthrow also are concerns of management. Seedling loss may be high because of the wetness. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. To minimize windthrow damage, intermediate and regeneration cuts should be carefully planned to give maximum protection from the wind.

This soil is not suited to use as a site for sanitary facilities or to building site development because of the high water table, the hazard of ponding, and the instability of the soil material. These limitations are extremely difficult to overcome.

This map unit is in capability subclass VIw and Michigan soil management group Mc-a.

49B—Hillsdale-Riddles sandy loams, 1 to 6 percent slopes. These are nearly level and undulating, well drained soils on broad, flat uplands and on low ridges and knolls (fig. 10). The areas are irregular in shape and range from 3 to 500 or more acres. The Hillsdale soils

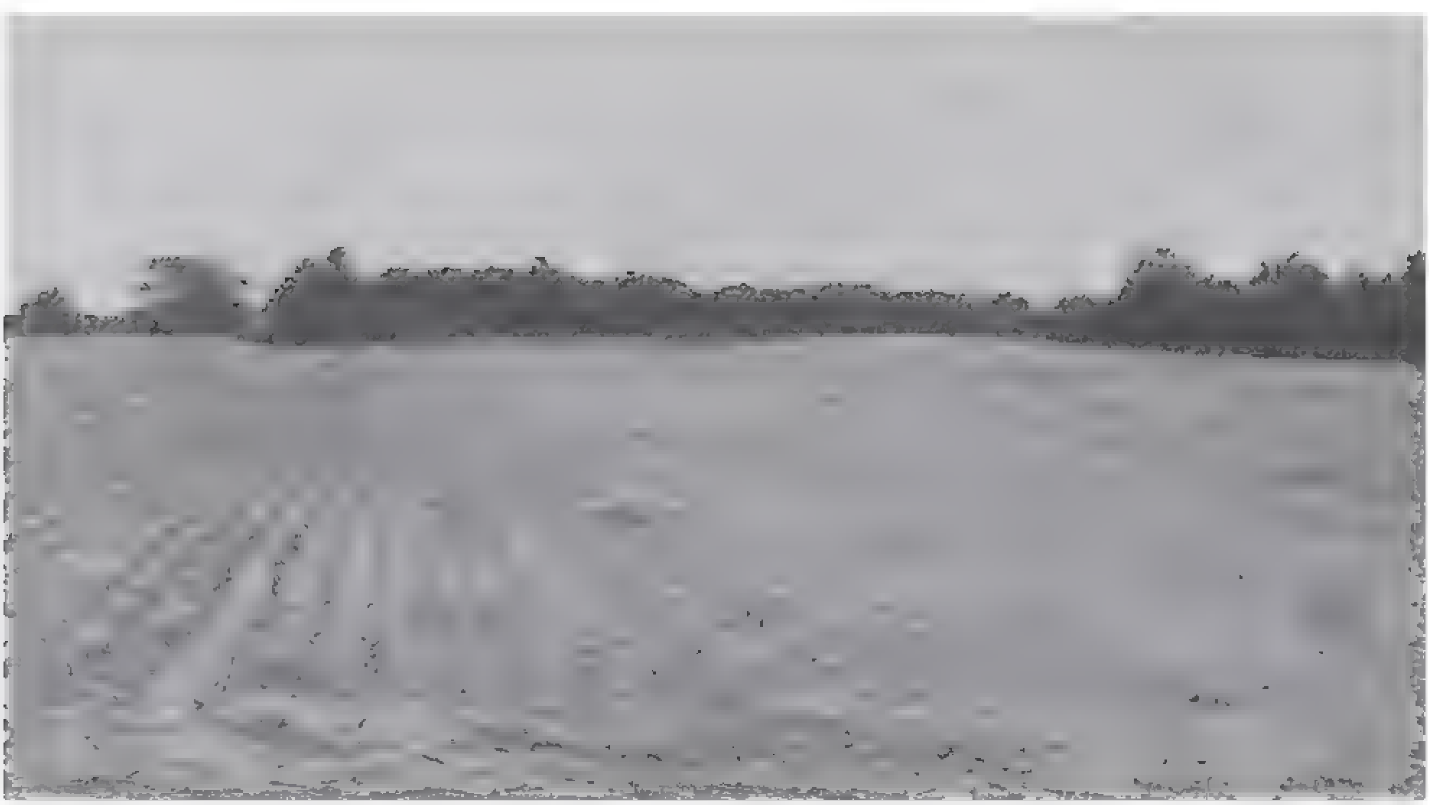


Figure 10.—Typical area of Hillsdale-Riddles sandy loams, 1 to 6 percent slopes.

make up 45 to 65 percent of this complex, and the Riddles soils make up 20 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Hillsdale soil has a surface layer that is dark grayish brown sandy loam about 10 inches thick. The subsurface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil is about 48 inches thick. In the upper part it is dark yellowish brown, friable sandy loam; in the middle part it is dark brown and dark yellowish brown, firm sandy loam; and in the lower part it is dark yellowish brown and yellowish brown, friable sandy loam. The substratum to a depth of about 66 inches is yellowish brown, calcareous sandy loam.

Typically, the Riddles soil has a surface layer that is dark brown sandy loam about 9 inches thick. The subsurface layer is yellowish brown sandy loam about 4 inches thick. The subsoil is about 41 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam, in the middle part it is dark yellowish brown, friable sandy clay loam; and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some areas the substratum is at a depth of less than 40 inches, and in some areas it is gravelly sand.

Included in mapping are small areas of well drained Spinks and Arkport soils that have more sand in the subsoil than the Hillsdale and Riddles soils. These Spinks and Arkport soils are scattered throughout the complex, and they make up 5 to 20 percent of the complex. Also included are small areas of somewhat poorly drained Teasdale soils in depressions and drainageways. These soils make up about 5 percent of the complex. Also included are small areas of well drained Leoni soils that have more pebbles and cobbles in the subsoil than the Hillsdale and Riddles soils. These Leoni soils are scattered throughout the complex, and they make up about 5 percent of the complex.

Permeability is moderate. The available water capacity is moderate. Surface runoff is slow.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. They have good potential for use as cropland, pasture, hayland, and woodland and for recreation uses. The Riddles soil has good potential for use as septic tank absorption fields and fair potential for use as a site for sewage lagoons, it has fair potential for building site development. The Hillsdale soil has fair potential for use as septic tank absorption fields, poor potential for use as a site for sewage lagoons, and good potential for most kinds of building site development.

If these soils are cultivated, controlling soil blowing and water erosion and maintaining the content of organic matter are the major concerns of management. Tree windbreaks, buffer strips, and conservation tillage help to control soil blowing. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding of other organic matter help to maintain or increase the content of organic matter.

The use of these soils as pasture and hayland is effective in controlling erosion. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff.

If these soils are used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

These soils are suited to use as septic tank absorption fields. The use of these soils as sites for sewage lagoons is limited by the hazard of seepage and by slope. Sealing the bottom and sides of sewage lagoons with impervious material can control seepage. Landshaping helps to overcome the slope limitation.

Hillsdale soils are well suited to building site development. The use of the Riddles soils for building site development is limited by the shrinking and swelling of the soil material. The shrinking and swelling can be controlled by replacing the upper layers of the soil with suitable material.

This complex is in capability subclass IIe and Michigan soil management groups 3a and 2.5a.

49C—Hillsdale-Riddles sandy loams, 6 to 12 percent slopes. These are rolling, well drained soils on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 3 to more than 200 acres. The Hillsdale soil makes up 45 to 65 percent of this complex and the Riddles soil makes up 20 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Hillsdale soil has a surface layer that is dark grayish brown sandy loam about 8 inches thick. The subsurface layer is dark yellowish brown sandy loam about 4 inches thick. The subsoil is about 46 inches thick. In the upper part it is dark yellowish brown, friable sandy loam; in the middle part it is dark brown and dark yellowish brown, firm sandy loam, and in the lower part it is dark yellowish brown and yellowish brown, friable sandy loam. The substratum to a depth of about 66 inches is yellowish brown, calcareous sandy loam.

Typically, the Riddles soil has a surface layer that is dark brown sandy loam about 8 inches thick. The subsurface layer is yellowish brown sandy loam about 4 inches thick. The subsoil is about 39 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam; in the middle part it is dark yellowish brown, friable sandy clay loam; and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some areas the substratum is at a depth of less than 40 inches, and in some areas it is gravelly sand.

Included in mapping are small areas of well drained Spinks and Arkport soils that have more sand in the subsoil than the Hillsdale and Riddles soils. These Spinks and Arkport soils are scattered throughout the complex, and they make up about 5 to 20 percent of the complex. Also included are small areas of somewhat poorly drained Teasdale soils in depressions and drainageways. These soils make up about 5 percent of the complex. Also included are small areas of well drained Leoni soils that have more pebbles and cobbles in the subsoil than the Hillsdale and Riddles soils. These Leoni soils are scattered throughout the complex, and they make up about 5 percent of the complex.

Permeability is moderate. The available water capacity is moderate. Surface runoff is medium.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. They have good potential for use as pasture, hayland, and woodland. They have fair potential for use as cropland, for most recreation uses, for use as septic tank absorption fields, and for building site development. They have poor potential for use as sites for sewage lagoons.

If these soils are cultivated, controlling soil blowing and water erosion and maintaining the content of organic matter are major concerns of management. Tree windbreaks, buffer strips, and conservation tillage help to control soil blowing. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. A rotation that includes crops that return organic residue to the soil and the regular addition of other organic matter maintain or increase the content of organic matter.

The use of these soils as pasture or hayland is effective in controlling erosion. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff.

If these soils are used as woodland, plant competition is a major concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs. Herbicides also help.

The use of these soils as sites for septic tank absorption fields is limited by slope. Installing the absorption field across the slope helps to offset this limitation. These soils generally are not suited to use as sites for sewage lagoons because of slope.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. Cleared areas around construction sites should be protected from erosion by the use of mulch, asphalt spray, or netting or by grass seeding. On the Riddles soil, the shrinking and swelling of the subsoil is an additional limitation to building site development. This limitation can be overcome by replacing the subsoil material with more suitable soil material.

This complex is in capability subclass IIIe and Michigan soil management groups 3a and 2.5a.

49D—Hillsdale-Riddles sandy loams, 12 to 18 percent slopes. These are hilly, well drained soils on hills, ridges, and knolls. The areas are irregular in shape and range from 3 to more than 100 acres. The Hillsdale soil makes up 45 to 65 percent of this complex, and the Riddles soil makes up 20 to 40 percent. The areas of these soils are so intricately mixed or are so small that it is not practical to separate them in mapping at the scale used.

Typically, the Hillsdale soil has a surface layer that is dark grayish brown sandy loam about 7 inches thick. The subsurface layer is dark yellowish brown sandy loam about 3 inches thick. The subsoil is about 45 inches thick. In the upper part it is dark yellowish brown, friable sandy loam; in the middle part it is dark brown and dark yellowish brown, friable sandy loam; and in the lower part it is dark yellowish brown and yellowish brown, friable sandy loam. The substratum to a depth of about 66 inches is yellowish brown, calcareous sandy loam.

Typically, the Riddles soil has a surface layer that is dark brown sandy loam about 7 inches thick. The subsurface layer is yellowish brown sandy loam about 3 inches thick. The subsoil is about 37 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam; in the middle part it is dark yellowish brown, friable sandy clay loam, and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some areas the substratum is at a depth of less than 40 inches, and in some areas it is gravelly sand.

Included in mapping are small areas of well drained Spinks and Arkport soils that have more sand in the subsoil than the Hillsdale and Riddles soils. These Spinks and Arkport soils are scattered throughout the complex, and they make up about 5 to 20 percent of the complex. Also included are small areas of somewhat poorly drained Teasdale soils in depressions and drainageways. They make up 5 percent of the complex. Also included are small areas of well drained Leoni soils that have more pebbles and cobbles in the subsoil than the Hillsdale and Riddles soils. These Leoni soils are scattered throughout the complex, and they make up about 5 percent of the complex.

Permeability is moderate. The available water capacity is moderate. Surface runoff is rapid.

In most areas these soils are used as cropland or pasture. In some areas they are used as woodland. They have good potential for use as pasture and hayland. They have poor potential for use as cropland, for most recreation uses, for use as septic tank absorption fields, for use as sites for sewage lagoons, and for building site development.

If these soils are cultivated, controlling soil blowing and water erosion, maintaining the content of organic matter, and overcoming equipment limitations associated with slope are the major concerns of management. Tree windbreaks, buffer strips, cover crops, and conservation

tillage help to control soil blowing. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help maintain or increase the content of organic matter. Farming on the contour minimizes the equipment limitations associated with slope.

The use of these soils as pasture or hayland is effective in controlling erosion. If these soils are used as pasture and hayland, overcoming equipment limitations associated with slope is a major concern of management. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion. Seeding and fertilizing on the contour minimize the equipment limitations.

If these soils are used as woodland, plant competition is a major concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

These soils are generally not suitable for use as sites for sewage lagoons and for use as septic tank absorption fields because of slope.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. Cleared areas around construction sites should be protected from soil erosion by the use of mulch, asphalt spray, or netting or by grass seeding. On the Riddles soils, the shrinking and swelling of the subsoil is an additional limitation to building site development. This limitation can be overcome by replacing the subsoil material with more suitable soil material.

This complex is in capability subclass IVe and Michigan soil management groups 3a and 2.5a.

49E—Hillsdale-Riddles sandy loams, 18 to 30 percent slopes. These are steep and very steep, well drained soils on hills and ridges and on side slopes along streams. The areas are irregular in shape and range from 3 to 100 acres. The Hillsdale soil makes up 45 to 65 percent of this complex, and the Riddles soil makes up 20 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Hillsdale soil has a surface layer that is dark grayish brown sandy loam about 5 inches thick. The subsurface layer is dark yellowish brown sandy loam about 3 inches thick. The subsoil is about 43 inches thick. In the upper part it is dark yellowish brown, friable sandy loam; in the middle part it is dark brown and dark yellowish brown, friable sandy loam, and in the lower part it is dark yellowish brown and yellowish brown, friable sandy loam. The substratum to a depth of about 66 inches is yellowish brown, calcareous sandy loam.

Typically the Riddles soil has a surface layer that is dark brown sandy loam about 6 inches thick. The subsurface layer is yellowish brown sandy loam about 3 inches thick. The subsoil is about 37 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam, in the middle part it is dark yellowish brown, friable sandy clay loam; and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some areas the substratum is at a depth of less than 40 inches, and in some areas it is gravelly sand.

Included in mapping are small areas of well drained Spinks and Arkport soils that have more sand in the subsoil than the Hillsdale and Riddles soils. These Spinks and Arkport soils are scattered throughout the complex, and they make up about 5 to 20 percent of the complex. Also included are small areas of somewhat poorly drained Teasdale soils in depressions and drainageways. These soils make up about 5 percent of the complex. Also included are small areas of well drained Leoni soils that have more pebbles and cobbles in the subsoil than the Hillsdale and Riddles soils. These Leoni soils are scattered throughout the complex and they make up about 5 percent of the complex.

Permeability is moderate. The available water capacity is moderate. Surface runoff is rapid.

In most areas these soils are used as pasture and woodland. They have good potential use as woodland and as habitat for woodland wildlife. They have fair potential for use as pasture and hayland and as habitat for openland wildlife. These soils have poor potential for use as cropland, for recreation uses, for use as sites for sanitary facilities, and for building site development. They have very poor potential for use as habitat for wetland wildlife.

Crop production is generally not economically practical on these soils because of the steepness of slope.

If these soils are used as pasture and hayland, equipment limitations associated with slope and a hazard of water erosion are major concerns of management. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff.

If these soils are used as woodland, equipment limitations, erosion, and plant competition are concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted because of the steepness of slope. Limiting the construction of logging roads and skid trails to the gentler slopes helps prevent erosion and overcome the equipment limitations. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

These soils are generally not suited to use as septic tank absorption fields, to use as sites for sewage lagoons, and to building site development because of the steepness of slope.

This complex is in capability subclass VIe and Michigan soil management groups 3a and 2.5a.

51—Udorthents and Udipsamments, nearly level. This map unit consists of soils from which the original surface layer and subsoil and some of the substratum have been removed or of soils that are covered by fill. The soil material is somewhat excessively drained to somewhat poorly drained. The areas range from 3 to 60 or more acres.

These soils vary greatly in some important soil properties, especially texture and drainage.

Included in mapping are small areas of poorly drained soils that make up 5 to 10 percent of the unit.

Most areas of these soils are idle or are used as building sites. Many areas are filled with organic soil. Some areas are sanitary landfills. Onsite investigation is necessary for specific uses.

This map unit is not assigned to an interpretive grouping.

52—Pits, gravel. This is a miscellaneous area that consists of open excavations from which sand and gravel have been removed for use as fill or aggregate (fig. 11). The exposed material supports few plants. Where the excavation extends below the water table, the bottom may be flooded seasonally or year round. Areas range from 3 to 80 acres.

Figure 11.—This gravel pit is in an area of Boyer-Leoni complex, 18 to 40 percent slopes.

Figure 12.—This sandstone quarry is in an area of Eleva sandy loam, 1 to 6 percent slopes, near Napoleon

Most areas are used as wildlife habitat or are still being mined. A few areas are used for recreation. The potential is poor for use as cropland, pasture, and woodland. The areas are too variable to be rated for other uses. Onsite investigation is necessary for specific uses.

This miscellaneous area is not assigned to an interpretive grouping.

53—Pits, quarries. This is a miscellaneous area that consists of open excavations from which limestone or sandstone has been removed (fig. 12). The exposed rock supports few or no plants. Where the excavation is below the water table, the bottom may be flooded seasonally year around. Areas range from 40 to 60 or more acres.

Most areas are still being mined. The potential is poor for use as cropland, pasture, woodland. The areas are too variable to be rated for other uses. Onsite investigation is necessary for specific uses.

This miscellaneous area is not assigned to an interpretive grouping.

55B—Eleva sandy loam, 1 to 6 percent slopes. This is an undulating, well drained and somewhat excessively drained soil on broad, flat uplands and on low ridges and knolls. The areas are irregular in shape and range from 3 to 120 or more acres.

Typically, the surface layer is dark brown sandy loam about 10 inches thick. The subsurface layer is yellowish brown sandy loam about 6 inches thick. The subsoil is dark yellowish brown and brown, friable sandy loam about 13 inches thick. The substratum to a depth of about 45 inches is dark yellowish brown weathered sandstone and channery loamy sand. In some places, the surface layer is loamy sand or sand. In some areas the weathered sandstone and channery loamy sand are at a depth of more than 60 inches.

Included in mapping are small areas of somewhat poorly drained Teasdale and Brady soils in depressions. These soils make up 5 to 10 percent of the map unit.

Permeability is moderate or moderately rapid. The available water capacity is low. Surface runoff is slow. The root zone is restricted by the bedrock.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. In some places, this soil is used as a source of sandstone. This soil has good potential for use as pasture and hayland and for most recreation uses. It has fair potential for use as cropland and woodland and for most kinds of building site development. It has poor potential for use as a site for sewage lagoons and for use as septic tank absorption fields.

If this soil is cultivated, controlling soil blowing, maintaining the content of organic matter, and conserving soil moisture during dry periods are the major concerns of management. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. Irrigation should increase crop yields.

If this soil is used as pasture and hayland, the hazard of droughtiness is a major concern of management. In summer this soil often does not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry periods. Overgrazing during the dry periods increases the hazard of soil blowing.

This soil is generally not suited to use as a site for sewage lagoons and to use as septic tank absorption fields because of the depth to bedrock, the hazard of seepage, and the poor filtering capacity. It is well suited to use as a site for dwellings without basements. It can be used as a site for dwellings with basements if fill material is used to raise the site. The fill material should be well compacted.

This map unit is in capability subclass IIIe and Michigan soil management group 3/Ra.

55C—Eleva sandy loam, 6 to 12 percent slopes. This is a rolling, well drained and somewhat excessively drained soil on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 3 to 80 or more acres.

Typically, the surface layer is dark brown sandy loam about 9 inches thick. The subsurface layer is yellowish brown sandy loam about 5 inches thick. The subsoil is dark yellowish brown and brown, friable sandy loam about 13 inches thick. The substratum to a depth of about 43 inches is dark yellowish brown weathered sandstone and channery loamy sand. In some places, the surface layer is loamy sand or sand. In some places, the weathered sandstone and channery loamy sand are at a depth of more than 60 inches.

Included in mapping are small areas of somewhat poorly drained Teasdale and Brady soils in depressions. These soils make up 5 to 10 percent of the map unit.

Permeability is moderate or moderately rapid. The available water capacity is low. Surface runoff is medium. The root zone is restricted by the bedrock.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as pasture and hayland and for most recreation uses. It has fair potential for use as cropland and woodland and for most kinds of building site development. It has poor potential for use as a site for sewage lagoons and for use as septic tank absorption fields.

If this soil is cultivated, controlling soil blowing and water erosion, maintaining the content of organic matter, and conserving soil moisture during dry periods are the major concerns of management. Tree windbreaks, buffer strips, cover crops, conservation tillage, and stubble mulching help to control soil blowing. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture.

The use of this soil as pasture or hayland is effective in controlling erosion. If this soil is used as pasture and hayland, the hazard of droughtiness is a major concern of management. In summer, this soil often does not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry periods. Overgrazing during the dry periods increases the hazard of soil blowing. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

This soil is generally not suited to use as a site for sewage lagoons and to use as septic tank absorption fields because of the depth to bedrock, the hazard of seepage, and the poor filtering capacity.

The use of this soil for building site development is limited by the depth to bedrock and slope. For buildings,

the slope limitation can be overcome by shaping the site and by using retaining walls. This soil can be used as a site for dwellings with basements if fill material is used to raise the site. The fill material should be well compacted. Roads and streets should be built on the contour.

This map unit is in capability subclass IIIe and Michigan soil management group 3/Ra.

56D—Riddles-Leoni complex, 10 to 20 percent slopes. These are rolling to steep, well drained soils on hills, ridges, knolls, and slopes adjacent to streams. The areas are irregular in shape and range from 3 to 60 or more acres. The Riddles soils make up 40 to 60 percent of this complex and the Leoni soils make up 20 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Riddles soils have a surface layer that is dark brown sandy loam about 7 inches thick. The subsurface layer is yellowish brown sandy loam about 3 inches thick. The subsoil is about 37 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam; in the middle part it is dark yellowish brown, friable sandy clay loam; and in the lower part it is dark yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some places, the subsoil contains less clay. In some areas the substratum is at a depth of less than 40 inches, and in some areas it is gravelly sand.

Typically, the Leoni soils have a surface layer that is very dark grayish brown gravelly sandy loam about 6 inches thick. The subsoil is dark brown and is about 35 inches thick. In the upper part it is firm gravelly sandy clay loam, and in the lower part it is firm and friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, calcareous very gravelly loamy sand.

Included in mapping are small areas of well drained Boyer and Spinks soils that have more sand in the subsoil and in the substratum than the Riddles and Leoni soils. These Boyer and Spinks soils are scattered throughout the complex, and they make up 10 to 15 percent of it.

Permeability in the Riddles soils is moderate. Permeability in the Leoni soils is moderate in the surface layer and the subsoil and rapid or moderately rapid in the substratum. The available water capacity is moderate for the Riddles soils and low for the Leoni soils. Surface runoff is rapid.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as pasture, hayland, and woodland. They have fair potential for use as cropland. They have poor potential for recreation uses, for use as sites for sanitary facilities, and for building site development.

If these soils are cultivated, controlling water erosion, maintaining the content of organic matter and good soil tilth, and overcoming equipment limitations associated with slope are the major concerns of management. Equipment limitations associated with the high content of gravel and cobbles is an additional concern on the Leoni soils. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. Working these soils when they are too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth. Farming on the contour helps to minimize equipment limitations associated with slope. In most areas there are enough cobbles in the surface layer to make seedbed preparation and harvesting difficult.

The use of these soils as pasture or hayland is effective in controlling erosion. If these soils are used as pasture and hayland, the hazard of droughtiness and equipment limitations associated with slope are major concerns of management. In summer the Leoni soils often do not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry periods. Maintaining an adequate vegetative cover by preventing overgrazing helps to control erosion. Seeding and fertilizing on the contour minimize the equipment limitations associated with slope.

If these soils are used as woodland, plant competition is a concern of management on the Riddles soils. Intensive site preparation and herbicides help to control the growth of undesirable vegetation.

These soils are generally not suitable for use as sites for sewage lagoons and for use as septic tank absorption fields because of slope.

The use of these soils for building site development is limited by slope and by the shrinking and swelling of the subsoil. For buildings, the slope limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. Cleared areas around construction sites should be protected from erosion by the use of mulch, asphalt spray, or netting or by grass seeding. The shrinking and swelling can be overcome by replacing the subsoil material with more suitable soil material.

This complex is in capability subclass IVe and Michigan soil management groups 2.5a and Ga.

57A—Urban land-Barry-Brady complex, 0 to 3 percent slopes. This complex consists of Urban land, nearly level, poorly drained Barry soils; and nearly level and gently sloping, somewhat poorly drained Brady soils. The Barry soils are in flat areas, depressions, and drainageways. The Brady soils are on low knolls and

ridges and along drainageways. The areas of this complex are irregular in shape and range from 10 to 500 or more acres. This complex is 40 to 75 percent Urban land, 0 to 30 percent Barry soils, and 0 to 30 percent Brady soils. The areas of Urban land and the Barry and Brady soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the soils is not feasible.

Typically, the Barry soils have a surface layer that is black loam about 10 inches thick. The subsoil is mottled and is about 20 inches thick. In the upper part it is dark olive gray, friable loam; in the next part it is dark gray, firm sandy clay loam; in the next part it is olive, friable sandy clay loam; and in the lower part it is olive, very friable sandy loam. The substratum to a depth of about 60 inches is grayish brown and calcareous. In the upper 14 inches it is sandy loam and in the lower 16 inches it is loamy sand. In some areas the surface layer is less than 10 inches thick. In some places, the subsoil contains less clay. Also in some areas the substratum is stratified sandy, loamy, and silty material or sand and gravelly sand.

Typically, the Brady soils have a surface layer that is dark yellowish brown sandy loam about 10 inches thick. The subsurface layer is brown sandy loam about 3 inches thick. The subsoil is mottled and is about 41 inches thick. In the upper part it is yellowish brown, friable sandy loam, and in the lower part it is yellowish brown, very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous sand. In some places, the surface layer is darker. In some places, the subsoil and the substratum contain more clay; and in some places, the subsoil is stratified sand and loamy sand.

Included in mapping are small areas of well drained Oshtemo and Riddles soils. These soils are on ridges and knolls and make up about 5 to 10 percent of the complex. Also included are small areas of very poorly drained Palms soils. These soils have organic layers and are in depressions. They make up about 5 to 10 percent of the complex. In some areas the soils have been radically altered. Some of the low areas have been filled or leveled during construction, and other areas have been cut, built up, or smoothed. In some areas sandstone bedrock is within 5 feet of the surface.

Permeability in the Barry soils is moderate. Permeability in the Brady soils is moderately rapid in the upper part of the profile and very rapid in the lower part. The available water capacity is high for the Barry soils and moderate for the Brady soils. Surface runoff is slow. The Barry soils have a high water table at or above the surface from November to May, and the Brady soils have a high water table 1 to 3 feet below the surface from November to May.

The Barry and Brady soils make up the lawns, gardens, parks, and other open parts of the complex. They have good potential for lawns, vegetable and flower gardens, and trees and shrubs. They have poor potential for recreation uses, sanitary facilities, and building site development.

The use of Barry and Brady soils as septic tank absorption fields and for building site development is limited by the high water table. These soils are subject to frost action. Sanitary facilities will not function properly because of the high water table. Only public sewage facilities should be used.

This complex is not assigned to an interpretive grouping.

58B—Urban land-Oshtemo complex, 0 to 6 percent slopes. This complex consists of Urban land and nearly level and undulating, well drained Oshtemo soils on broad, flat uplands and low knolls and ridges. The areas are irregular in shape and range from 5 to 600 or more acres. The Urban land makes up 50 to 80 percent of the complex, and the Oshtemo soils make up 10 to 40 percent. The areas of Urban land and Oshtemo soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the soils is not feasible.

Typically, the Oshtemo soils have a surface layer that is dark brown sandy loam about 10 inches thick. The subsurface layer is yellowish brown sandy loam about 7 inches thick. The subsoil is about 35 inches thick. In the upper part it is strong brown, friable gravelly sandy loam; in the middle part it is yellowish red, firm gravelly sandy clay loam; and in the lower part it is strong brown, loose sand and bands, 1/8 to 1 inch thick, of very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown calcareous gravelly sand. In some places, the sandy material above the subsoil is 20 or more inches thick. In some places the subsoil contains more clay. In some areas the substratum is at a depth of less than 40 inches. Also in some areas the subsoil is more than 30 percent pebbles.

Included in mapping are small areas of somewhat poorly drained Brady soils and very poorly drained Gilford soils in depressions and drainageways. These soils make up 5 to 15 percent of the complex. Also included are small areas of very poorly drained Palms soils in depressions. These soils make up about 5 percent of the complex. In some areas the soil material has been radically altered. Some of the low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed. In some areas sandstone bedrock is within 5 feet of the surface.

Permeability in the Oshtemo soils is moderately rapid in the upper part of the profile and very rapid in the lower part. The available water capacity is moderate. Surface runoff is slow.

The Oshtemo soils make up the lawns, gardens, parks, and other open parts of the complex. They have

good potential for lawns, vegetable and flower gardens, trees and shrubs, recreation uses, and most kinds of building site development. They have poor potential for sanitary facilities.

The use of the Oshtemo soils as septic tank absorption fields is limited by the poor filtering capacity. Only public sewage facilities should be used.

This complex is not assigned to an interpretive grouping.

58C—Urban land-Oshtemo complex, 6 to 15 percent slopes. This complex consists of Urban land and rolling and hilly, well drained Oshtemo soils on broad uplands consisting of knolls and ridges. The areas are irregular in shape and range from 5 to 200 or more acres. The Urban land makes up 50 to 80 percent of the complex, and the Oshtemo soils make up 10 to 40 percent. The areas of Urban land and Oshtemo soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the soils is not feasible.

Typically, the Oshtemo soils have a surface layer that is dark brown sandy loam about 8 inches thick. The subsurface layer is yellowish brown sandy loam about 7 inches thick. The subsoil is about 35 inches thick. In the upper part it is strong brown, friable gravelly sandy loam; in the middle part it is yellowish red, firm gravelly sandy clay loam; and in the lower part it is strong brown, loose sand and bands, 1/8 to 1 inch thick, of very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, calcareous gravelly sand. In some places the sandy material above the subsoil is 20 or more inches thick. In some places, the subsoil contains more clay. In some areas the substratum is at a depth of less than 40 inches. Also in some areas the subsoil is more than 30 percent pebbles.

Included in mapping are small areas of somewhat poorly drained Brady soils and very poorly drained Gilford soils in depressions and drainageways. These soils make up 5 to 15 percent of the complex. Also included are small areas of very poorly drained Palms soils in depressions. These soils make up about 5 percent of the complex. In some areas the soil material has been radically altered. Small areas have been filled, leveled, built up, cut, or smoothed during construction. In some areas sandstone bedrock is within 5 feet of the surface.

Permeability in the Oshtemo soils is moderately rapid in the upper part of the profile and very rapid in the lower part. The available water capacity is moderate. Surface runoff is medium.

The Oshtemo soils make up the lawns, gardens, parks, and other open parts of the complex. They have good potential for trees and shrubs. They have fair potential for lawns, vegetable and flower gardens, most recreation uses, and most kinds of building site development. They have poor potential for sanitary facilities.

The use of the Oshtemo soils as septic tank absorption fields is limited by poor filtering capacity. Only public sewage facilities should be used.

This complex is not assigned to an interpretive grouping.

59B—Urban land-Riddles complex, 0 to 6 percent slopes. This complex consists of Urban land and nearly level and undulating, well drained Riddles soils on broad, flat uplands and on low knolls and ridges. The areas are irregular in shape and range from 10 to 200 or more acres. The Urban land makes up 50 to 80 percent of the complex, and the Riddles soils make up 10 to 40 percent. The areas of Urban land and Riddles soil are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the soils is not feasible.

Typically, the Riddles soils have a surface layer that is dark brown sandy loam about 9 inches thick. The subsurface layer is yellowish brown sandy loam about 4 inches thick. The subsoil is about 41 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam; in the middle part it is dark yellowish brown, firm sandy clay loam; and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some places, the subsoil contains less clay. In some areas the substratum is at a depth of less than 40 inches, and in some areas it is gravelly sand. In some places, the content of pebbles and cobbles is more than 10 percent.

Included in mapping are small areas of somewhat poorly drained Teasdale and Brady soils in depressions and drainageways. These soils make up 5 to 10 percent of the complex. Also included are small areas of very poorly drained Palms soils in depressions. These soils make up about 5 percent of the complex. In some areas the soil material has been radically altered. Some of the low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed. In some areas sandstone bedrock is within 5 feet of the surface.

Permeability is moderate. The available water capacity is moderate. Surface runoff is slow.

The Riddles soils make up the lawns, gardens, parks, and other open parts of the complex. They have good potential for lawns, vegetable and flower gardens, trees and shrubs, recreation uses, and most kinds of building site development and for use as septic tank absorption fields.

This complex in not assigned to an interpretive grouping.

59C—Urban land-Riddles complex, 6 to 15 percent slopes. This complex consists of Urban land and rolling

and hilly, well drained Riddles soils on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 10 to 60 or more acres. The Urban land makes up 50 to 80 percent of the complex, and the Riddles soils make up 10 to 40 percent. The areas of Urban land and Riddles soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the soils is not feasible.

Typically, the Riddles soils have a surface layer that is dark brown sandy loam about 8 inches thick. The subsurface layer is yellowish brown sandy loam about 4 inches thick. The subsoil is about 39 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam, in the middle part it is dark yellowish brown, firm sandy clay loam; and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some places the subsoil contains less clay. In some areas the substratum is at a depth of less than 40 inches, and in some areas it is gravelly sand. In some places, the content of pebbles and cobbles is more than 10 percent.

Included in mapping are small areas of somewhat poorly drained Teasdale and Brady soils in depressions and drainageways. These soils make up 5 to 10 percent of the complex. Also included are small areas of very poorly drained Palms soils in depressions. These soils make up about 5 percent of the complex. In some areas the soil material has been radically altered. Some of the low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed. In some areas sandstone bedrock is within 5 feet of the surface.

Permeability is moderate. The available water capacity is moderate. Surface runoff is medium.

The Riddles soils make up the lawns and gardens, parks, and other open parts of the complex. They have good potential for lawns and trees and shrubs. They have fair potential for vegetable and flower gardens, recreation uses, septic tank absorption fields, and most kinds of building site development.

This complex is not assigned to an interpretive grouping.

60—Urban land-Udorthents complex. This complex consists of Urban land and nearly level and gently sloping, well drained to somewhat poorly drained soils. The areas are irregular in shape and range from 5 to 300 or more acres. The Urban land makes up 50 to 80 percent of the complex, and the Udorthents make up 10 to 40 percent. The areas of Urban land and Udorthents are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the soils is not feasible.

The Udorthents vary greatly in some important soil properties, especially texture and drainage. The original soil material has been removed or has been covered with fill.

Included in mapping are small areas of poorly drained soils that make up 5 to 10 percent of the complex. In some areas, sandstone bedrock is within 5 feet of the surface.

The Udorthents are idle or are used as building sites. Onsite investigation is necessary for specific uses.

This complex is not assigned to an interpretive grouping.

61B—Saylesville silt loam, 2 to 8 percent slopes. This is an undulating and rolling, well drained soil on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 3 to 60 or more acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown loam about 2 inches thick. The subsoil is silty clay loam about 12 inches thick. In the upper part it is yellowish brown, and in the lower part it is dark brown. The substratum to a depth of about 60 inches is brown, calcareous silty clay loam. In some places the subsoil contains less clay. In some areas the substratum is at a depth of less than 20 inches.

Included in mapping are small areas of well drained Arkport soils that have more sand in the subsoil and the substratum than the Saylesville soil. These soils are scattered throughout the map unit, and they make up about 5 percent of the unit. Also included are small areas of somewhat poorly drained Del Rey soils in depressions and on lower side slopes. These soils make up about 5 to 10 percent of the map unit.

Permeability is moderately slow. The available water capacity is high. Surface runoff is medium. This soil has a high water table 3 to 6 feet below the surface from November to May.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as cropland, pasture, hayland, and woodland. It has fair potential for most recreation uses and for use as a site for sewage lagoons. It has poor potential for use as septic tank absorption fields and for most kinds of building site development.

If this soil is cultivated, controlling water erosion and maintaining the content of organic matter and good soil tilth are the major concerns of management. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Working this soil when it is too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

The use of this soil as pasture or hayland is effective in controlling erosion. If this soil is used as pasture and

hayland, preventing surface compaction is a major concern of management. Overgrazing or grazing when this soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If this soil is used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

The use of this soil as septic tank absorption fields is limited by its moderately slow permeability. Conventional septic tank absorption fields generally are not practical in this soil. The use of this soil as a site for sewage lagoons is limited by slope. Landshaping helps overcome this limitation.

The use of this soil for building site development is limited by the shrinking and swelling of the soil. The shrinking and swelling can be controlled by replacing the upper layers with suitable soil material.

This map unit is in capability subclass IIe and Michigan soil management group 1.5a.

62A—Del Rey silt loam, 0 to 3 percent slopes. This is a nearly level and gently sloping, somewhat poorly drained soil in broad, flat areas and in depressional areas. The areas of this map unit are irregular in shape and range from 3 to 75 or more acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil, about 15 inches thick, is mottled, yellowish brown, firm silty clay. The substratum to a depth of 60 inches is yellowish brown, mottled, calcareous silty clay loam. In some places, the subsoil contains less clay.

Included in mapping are small areas of well drained Saylesville soils. These soils are on the tops of ridges and knolls, and they make up about 5 percent of the map unit. Also included are small areas of poorly drained Lenawee soils. These soils are in depressions and on lower side slopes, and they make up about 5 percent of the map unit.

Permeability is slow. The available water capacity is high. Surface runoff is slow. This soil has a high water table 1 to 3 feet below the surface from January to May.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as cropland, pasture, and hayland. It has fair potential for woodland use, for recreation uses, and for use as a site for sewage lagoons. It has poor potential for use as septic tank absorption fields and for building site development.

If this soil is cultivated, removing excess water during wet periods, controlling water erosion, and maintaining good soil tilth are major concerns of management. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Working this soil when it is too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

The use of this soil as pasture or hayland is effective in controlling erosion. If this soil is used as pasture and hayland, excess water during wet periods and surface compaction are the major concerns of management. Overgrazing or grazing on this soil when it is too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, seedling mortality and windthrow are concerns of management. Careful thinning helps to overcome the windthrow.

The use of this soil as septic tank absorption fields is severely limited by the seasonal high water table and by the slow permeability. Conventional septic tank absorption fields generally are not practical in this soil.

The use of this soil as a site for buildings is limited by the seasonal high water table. This soil can be used as a site for buildings without basements if suitable fill material is used to raise the site and if a subsurface drainage system is installed. The use of this soil as a site for local roads and streets is limited by the hazard of frost action in the soil and by the low strength of the soil. These limitations can be overcome by replacing or covering the upper layer of this soil with suitable base material.

This map unit is in capability subclass IIw and Michigan soil management group 1.5b.

63—Henrietta muck. This is a nearly level, very poorly drained soil in depressions and drainageways and along the edge of lakes. It is subject to frequent ponding. The areas are irregular in shape and range from 3 to 200 or more acres.

Typically, the surface layer is black muck about 12 inches thick. The subsoil is mottled and is about 31 inches thick. In the upper part it is light brownish gray, very friable loamy fine sand; in the middle part it is stratified, gray and light brownish gray, friable fine sandy loam and silt loam and loose fine sand; and in the lower part it is stratified, gray, friable silt loam and fine sandy loam. The substratum to a depth of about 60 inches is light brownish gray, calcareous loamy fine sand. In some areas the surface layer is less than 8 inches thick, and in some areas it is more than 16 inches thick. In some areas the substratum is marly.

Included in mapping are small areas of poorly drained Colwood soils and very poorly drained Gilford soils that

do not have an organic layer. These soils are on slightly higher positions along the edges of the map unit and they make up about 5 to 10 percent of the unit.

Permeability is moderate. The available water capacity is high. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface from November to May. This soil is often low in some micronutrients.

In most areas this soil has a cover of natural vegetation, including trees. In some areas it is drained for use as cropland. In a few areas it is used as pasture. This soil has good potential for use as cropland, especially for truck and specialty crops. It also has good potential for use as pasture and hayland. It has poor potential for woodland use, for recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water, controlling ponding, providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and overcoming equipment limitations associated with soil stability are major concerns of management. Frost action is a hazard in some areas. Artificial drainage is needed for crop production. Lift pumps may be needed at the drainage outlet in some areas. If this soil is drained, soil blowing is a hazard. Tree windbreaks, buffer strips, and cover crops help to control the soil blowing. Controlled drainage improves soil stability and reduces subsidence. This soil may be deficient in nutrients, especially micronutrients, needed by some crops; therefore, it needs to be tested. Fertilizer may be needed.

If this soil is used as pasture and hayland, excess water and surface compaction are the major concerns of management. Grazing when the soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, equipment limitations, plant competition, seedling mortality, and windthrow are concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted because of wetness. Intensive site preparation and herbicides help to control undesirable trees and shrubs. Seedling loss may be high because of the wetness. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. To minimize windthrow damage, stands should be thinned only slightly; mature stands can be clear cut.

This soil is not suited to use as a site for sanitary facilities and to building site development because of the high water table, the hazard of ponding, and the instability of the soil material. These limitations are extremely difficult to overcome.

This map unit is in capability subclass IIw and Michigan soil management group M/3c.

64B—Marlette-Owosso complex, 2 to 6 percent slopes. This complex consists of undulating, well drained Marlette soils and Owosso soils on broad nearly flat uplands and on low knolls and ridges. The areas are irregular in shape and range from 3 to 130 or more acres. The Marlette soils make up 40 to 60 percent of the complex, and the Owosso soils make up 20 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Marlette soils have a surface layer that is dark brown loam about 8 inches thick. The subsoil is about 24 inches thick. In the upper part it is dark yellowish brown, firm clay loam that has coatings of brown loam on the faces of peds, and in the lower part it is dark yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is brown, calcareous loam. In some areas the subsoil does not have the loam coatings on the faces of peds in the upper part. In some areas the substratum is at a depth of less than 25 inches.

Typically, the Owosso soils have a surface layer that is dark brown sandy loam about 8 inches thick. The subsoil is dark brown and is about 35 inches thick. In the upper part it is very friable and friable sandy loam, in the middle part it is firm sandy clay loam, and in the lower part it is dark brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous loam. In some places the subsoil contains less clay in the lower part.

Included in mapping are small areas of somewhat poorly drained Capac and Teasdale soils in depressions and drainageways and on foot slopes. These soils make up 10 to 15 percent of the complex. Also included are small areas of well drained Okee soils that have more sand in the surface layer and the subsoil than the Marlette and Owosso soils. These Okee soils are scattered throughout the complex, and they make up about 5 percent of the complex.

Permeability in the Marlette soils is moderate or moderately slow. Permeability in the Owosso soils is moderately rapid in the surface layer and in the upper part of the subsoil and moderately slow in the lower part of the subsoil and in the substratum. The available water capacity is high. Surface runoff is medium on the Marlette soils and slow on the Owosso soils.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as cropland, pasture, hayland, and woodland and for most recreation uses. They have fair potential for most kinds of building site development. They have poor potential for use as septic tank absorption fields. The Marlette soils have poor potential for use as sites for sewage lagoons, and the Owosso soils have fair potential.

If these soils are cultivated, controlling water erosion and maintaining the content of organic matter and good soil tilth are major concerns of management. Cover

crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Working these soils when they are too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth. Controlling soil blowing is an additional concern of management on the Owosso soils. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control the soil blowing.

The use of these soils as pasture or hayland is effective in controlling erosion. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If these soils are used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

The use of these soils as septic tank absorption fields is limited by the moderately slow permeability. Conventional septic tank absorption fields generally are not practical in these soils. The use of these soils as sites for sewage lagoons is limited by slope. Landshaping can help overcome this limitation.

These soils have few limitations for building site development. On the Owosso soils, shrinking and swelling is a limitation to this use. The shrinking and swelling can be controlled by replacing the pertinent layers with suitable soil material.

This complex is in capability subclass IIe and Michigan soil management groups 2.5a and 3/2a.

64C—Marlette-Owosso complex, 6 to 12 percent slopes. This complex consists of rolling, well drained Marlette soils and Owosso soils on broad uplands consisting of knolls and ridges and along streams. The areas are irregular in shape and range from 3 to 140 or more acres. The Marlette soils make up 40 to 60 percent of the complex, and the Owosso soils make up 20 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Marlette soils have a surface layer that is dark brown loam about 8 inches thick. The subsoil is about 24 inches thick. In the upper part it is dark yellowish brown, firm clay loam that has coatings of brown loam on the faces of peds; in the lower part it is dark yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is brown, calcareous loam. In some areas the subsoil does not have the loam coatings in the upper part. In some areas the substratum is at a depth of less than 25 inches.

Typically, the Owosso soils have a surface layer that is dark brown sandy loam about 8 inches thick. The subsoil is dark brown and is about 35 inches thick. In the upper part it is very friable and friable sandy loam; in the middle part it is firm sandy clay loam; and in the lower part it is firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous loam. In some places the subsoil contains less clay in the lower part.

Included in mapping are small areas of somewhat poorly drained Capac soils in depressions and drainageways and on foot slopes. These soils make up about 10 percent of the complex. Also included are small areas of well drained Okee soils that have more sand in the surface layer and the subsoil than the Marlette and Owosso soils. These Okee soils are scattered throughout the complex, and they make up 10 to 15 percent of the complex.

Permeability in the Marlette soils is moderate or moderately slow. Permeability in the Owosso soils is moderately rapid in the surface layer and the upper part of the subsoil and moderately slow in the lower part of the subsoil and the substratum. The available water capacity is high. Surface runoff is medium.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as pasture, hayland, and woodland. They have fair potential for use as cropland, for most recreation uses, and for building site development. These soils have poor potential for use as sites for sewage lagoons and for use as septic tank absorption fields.

If these soils are cultivated, controlling water erosion and maintaining the content of organic matter and good soil tilth are major concerns of management. Controlling soil blowing is an additional concern of management on the Owosso soils. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff, water erosion, and soil blowing. Windbreaks and buffer strips also help to control soil blowing. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Working these soils when they are too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

The use of these soils as pasture or hayland is effective in controlling erosion. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If these soils are used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

The use of these soils as septic tank absorption fields is limited by the moderately slow permeability and the slope. Conventional septic tank absorption fields generally are not practical in these soils. Installing the absorption field across the slope helps to overcome the slope limitation. These soils are generally not suited to use as sites for sewage lagoons because of the slope.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. Cleared areas around construction sites should be protected from erosion by the use of mulch, asphalt spray, or netting or by grass seeding. On the Owosso soils, shrinking and swelling is an additional limitation to building site development. This limitation can be overcome by replacing the pertinent layers with more suitable soil material.

This complex is in capability subclass IIIe and Michigan soil management groups 2.5a and 3/2a.

65A—Capac loam, 0 to 3 percent slopes. This is a nearly level and gently sloping, somewhat poorly drained soil in broad, flat areas, on low ridges and knolls, and on foot slopes. The areas of this map unit are irregular or elongated in shape and range from 3 to 240 or more acres.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is mottled and is about 26 inches thick. In the upper part it is dark yellowish brown and yellowish brown, friable loam; and in the lower part it is dark yellowish brown and yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is light olive brown, mottled, calcareous loam.

Included in mapping are small areas of well drained Marlette soils on high ridgetops and on the top of knolls. These soils make up about 5 percent of the map unit. Also included are small areas of somewhat poorly drained Teasdale soils that have less clay in the subsoil than the Capac soil. These soils are scattered throughout the map unit and they make up about 5 percent of the unit. Also included are small areas of poorly drained Barry soils in depressions and drainageways. These soils make up about 5 percent of the map unit.

Permeability is moderate or moderately slow. The available water capacity is high. Surface runoff is slow. This soil has a high water table 1 to 2 feet below the surface from November to May.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as cropland, pasture, hayland, and woodland. It has poor potential for most recreation uses, for use as sites for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water during wet periods and maintaining good soil tilth are major concerns of management. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Working this soil when it is too wet results in compaction and the formation of clods. Conservation tillage, cover crops, crop residue returned to the soil, and regular additions of other organic matter help to maintain good soil tilth.

If this soil is used as pasture and hayland, excess water during wet periods and surface compaction are major concerns of management. Overgrazing or grazing on this soil when it is too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, plant competition is a major concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

The use of this soil as septic tank absorption fields is severely limited by the seasonal high water table and by the moderate or moderately slow permeability.

The use of this soil as a site for buildings is limited by the seasonal high water table. This soil can be used as a site for buildings without basements if suitable fill material is used to raise the site and if a subsurface drainage system is installed. The use of this soil as a site for local roads and streets is limited by the hazard of frost action and the low strength of the soil. The included Marlette soils are better suited to building site development because they are better drained.

This map unit is in capability subclass IIw and Michigan soil management group 2.5b.

66E—Eleva Variant channery fine sandy loam, 15 to 30 percent slopes. This is a hilly to very steep, well drained soil on the side slopes of ridges and hills. The areas are irregular or elongated in shape and range from 3 to 80 or more acres.

Typically, the surface layer is very dark grayish brown channery fine sandy loam about 4 inches thick. The subsurface layer is yellowish brown channery fine sandy loam about 2 inches thick. The subsoil is yellowish brown, friable very channery sandy loam about 18 inches thick. The substratum to a depth of about 42 inches is yellowish brown weathered bedrock breaking to channery sandy loam. Unweathered sandstone bedrock is at a depth of about 42 inches. In some places, unweathered sandstone bedrock is at a depth greater than 60 inches. In some areas sandstone fragments make up less than 40 percent of the profile.

Included in mapping are small areas of well drained Hillsdale and Riddles soils. These soils do not have sandstone fragments in the subsoil or bedrock within a depth of 60 inches. They are scattered throughout the map unit, and they make up about 5 to 10 percent of the unit.

Permeability is moderately rapid. The available water capacity is low. Surface runoff is rapid.

In most areas this soil is used as woodland. In a few areas it is used as pasture. This soil has good potential

for woodland use. It has fair potential for use as pasture and hayland. It has poor potential for use as cropland, for recreation uses, for use as a site for facilities, and for building site development.

Crop production is usually not economically practical on this soil because of the steepness of slope.

If this soil is used as pasture and hayland, equipment limitations associated with slope and the hazards of water erosion and droughtiness are major concerns of management. In summer this soil often does not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry months. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If this soil is used as woodland, equipment limitations and plant competition are major concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted because of the steepness of slope. Constructing logging roads and skid trails on the gentler slopes helps to control erosion and overcome equipment limitations. Disking and the use of herbicides help to control the growth of undesirable vegetation.

This soil is generally not suited to use as septic tank absorption fields, to use a site for sewage lagoons, and to building site development because of slope and depth to sandstone.

This map unit is in capability subclass VIs and Michigan soil management group 3/Ra.

67B—Whalan loam, 1 to 6 percent slopes. This is a nearly level and undulating, well drained soil on broad, flat uplands and on low ridges and knolls. The areas are irregular in shape and range from 3 to 100 or more acres.

Typically, the surface layer is dark brown loam about 9 inches thick. The subsoil is about 21 inches thick. In the upper part it is dark yellowish brown loam; in the next part it is dark brown, firm clay loam; in the next part it is dark brown, firm silty clay loam; and in the lower part it is strong brown, friable silty clay loam. Unweathered limestone bedrock is at a depth of about 30 inches. In some areas the limestone bedrock is at a depth of more than 60 inches. In some places the subsoil contains less clay. In some areas the subsoil is mottled.

Included in mapping are small areas of well drained and somewhat excessively drained Eleva soils. These soils have less clay in the subsoil than the Whalan soil, and they are underlain by sandstone bedrock. They are scattered throughout the map unit and make up about 5 percent of the unit.

Permeability is moderate in the upper part of the solum but ranges to slow in the lower part of the solum. The available water capacity is high. Surface runoff is medium. The root zone is restricted by the bedrock.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. In some places, limestone is extracted. This soil has good potential for use as cropland, pasture, hayland, and woodland. It has fair potential for most recreation uses, for use as a site for sewage lagoons, and for most kinds of building site development. It has poor potential for use as septic tank absorption fields.

If this soil is cultivated, maintaining the content of organic matter and good soil tilth are major concerns of management. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Working this soil when it is too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

If this soil is used as pasture and hayland, preventing surface compaction is a major concern of management. Overgrazing or grazing when this soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, plant competition is a major concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

This soil is generally not suited to use as septic tank absorption fields, to use as a site for sewage lagoons, and to building site development because of the depth to limestone.

This map unit is in capability subclass IIe and Michigan soil management group 2/Ra.

68B—Oshtemo-Leoni complex, 1 to 6 percent slopes. These are nearly level and undulating, well drained soils on broad, flat uplands and on low ridges and knolls. The areas are irregular in shape and range from 3 to 200 or more acres. The Oshtemo soils make up 40 to 55 percent of the complex, and the Leoni soils make up 25 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Oshtemo soils have a surface layer that is dark brown sandy loam about 10 inches thick. The subsurface layer is yellowish brown sandy loam about 7 inches thick. The subsoil is about 33 inches thick. In the upper part it is strong brown, friable gravelly sandy loam; in the middle part it is yellowish red, firm gravelly sandy clay loam, and in the lower part it is strong brown, loose sand and bands, 1/8 to 1 inch thick, of dark brown, very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, calcareous gravelly sand. In some places, there is 20 or more inches of sandy material above the subsoil. In some places the subsoil contains more clay.

Typically, the Leoni soils have a surface layer that is very dark grayish brown gravelly sandy loam about 11 inches thick. The subsoil is dark brown and is about 29

inches thick. In the upper part it is firm gravelly sandy clay loam; and in the lower part it is firm and friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, calcareous very gravelly loamy sand. In some areas the substratum is at a depth of less than 40 inches.

Included in mapping are small areas of somewhat poorly drained Brady soils in depressions and drainageways. These soils make up about 5 percent of the complex. Also included are small areas of well drained Spinks soils that have more sand in the subsoil than the Oshtemo and Leoni soils. These Spinks soils are scattered throughout the complex, and they make up about 5 percent of the complex.

Permeability in the Oshtemo soils is moderately rapid in the surface layer and the subsoil and very rapid in the substratum. Permeability in the Leoni soils is moderate in the surface layer and the subsoil and moderately rapid in the substratum. The available water capacity is slow for the Leoni soils and moderate for the Oshtemo soils. Surface runoff is slow.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as pasture, hayland, and woodland. They have fair potential for use as cropland, for recreation uses, and for building site development. They have poor potential for use as sites for sewage lagoons and for use as septic tank absorption fields.

If these soils are cultivated, maintaining the content of organic matter and conserving soil moisture during dry periods are major concerns of management. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. Irrigation increases crop yields. In most areas of the Leoni soils the gravel in the surface layer makes seedbed preparation and harvesting difficult. Removing the gravel should increase crop yields and decrease equipment wear. Controlling soil blowing on the Oshtemo soils is an additional concern of management. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control the soil blowing.

If these soils are used as pasture and hayland, the hazard of droughtiness is a major concern of management. In summer these soils often do not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production on the Oshtemo and Leoni soils during the dry periods. Overgrazing during the dry periods can increase the hazard of soil blowing on the Oshtemo soils.

If these soils are used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

The use of these soils as sites for sewage lagoons is limited by the hazard of seepage. Sealing the bottom and sides of the lagoons with impervious material helps to control seepage. If the Oshtemo soils are used as septic tank absorption fields, ground water pollution is a hazard because the soil material cannot adequately filter the effluent. Filling or mounding the absorption field site with suitable material increases the filtering capacity of the Oshtemo soils. The Leoni soils are better suited to use as septic tank absorption fields than the Oshtemo soils.

These soils have few limitations for building site development. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced.

This complex is in capability subclass IIIs and Michigan soil management groups 3a and Ga.

68C—Oshtemo-Leoni complex, 6 to 12 percent slopes. These are rolling, well drained soils on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 3 to 100 acres. The Oshtemo soils make up 40 to 55 percent of the complex, and the Leoni soils make up 25 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Oshtemo soils have a surface layer that is dark brown sandy loam about 8 inches thick. The subsurface layer is yellowish brown sandy loam about 7 inches thick. The subsoil is about 33 inches thick. In the upper part it is strong brown, friable gravelly sandy loam; in the middle part it is yellowish red, firm gravelly sandy loam; and in the lower part it is strong brown, loose sand and bands, 1/8 to 1 inch thick, of dark brown, very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, calcareous gravelly sand. In some places there is 20 or more inches of sandy material above the subsoil.

Typically, the Leoni soils have a surface layer of very dark grayish brown gravelly sandy loam about 11 inches thick. The subsoil is dark brown and is about 29 inches thick. In the upper part it is firm gravelly sandy clay loam, and in the lower part it is firm and friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, calcareous very gravelly loamy sand. In some areas the substratum is at a depth of less than 40 inches.

Included in mapping are small areas of somewhat poorly drained Brady soils in depressions and drainageways. These soils make up about 5 percent of the complex. Also included are small areas of well drained Spinks soils that have more sand in the subsoil than the Oshtemo and Leoni soils. These Spinks soils are scattered throughout the complex, and they make up about 5 percent of the complex.

Permeability in the Oshtemo soils is moderately rapid in the surface layer and the subsoil and very rapid in the substratum. Permeability in the Leoni soils is moderate in the surface layer and the subsoil and rapid or moderately rapid in the substratum. The available water capacity is

low for the Leoni soils and moderate for the Oshtemo soils. The surface runoff is medium.

In most areas, these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as pasture, hayland, and woodland. They have fair potential for use as cropland, for recreation uses, and for most kinds of building site development. They have poor potential for use as sites for sewage lagoons and for use as septic tank absorption fields.

If these soils are cultivated, controlling water erosion, maintaining the content of organic matter, and conserving soil moisture during dry periods are major concerns of management. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. Controlling soil blowing on the Oshtemo soils is an additional concern. Tree windbreaks, buffer strips, cover crops, conservation tillage, and stubble mulching help to control the soil blowing. In most areas of the Leoni soils the gravel in the surface layer makes seedbed preparation and harvesting difficult. Removing the gravel should improve crop yields and decrease equipment wear.

The use of these soils as pasture or hayland is effective in controlling erosion. If these soils are used as pasture and hayland, the hazard of droughtiness is a major concern of management. In summer these soils often do not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production on the Oshtemo and Leoni soils during the dry periods. Overgrazing during the dry periods increases the hazard of soil blowing on the Oshtemo soils. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If these soils are used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

If these soils are used as septic tank absorption fields, ground water pollution is a hazard. The Oshtemo soils are limited for this use because of slope and inadequate filtration capacity, and the Leoni soils are limited because of slope. Installing the absorption field across the slope helps to overcome the slope limitation. In areas of the Oshtemo soils, filling or mounding the absorption field sites with suitable material increases the filtration capacity. The Oshtemo and Leoni soils are generally not suited to use as sites for sewage lagoons because of the slope and the hazard of seepage.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. On the Leoni soils, building site development is limited also by large stones and by the shrinking and swelling of the soil. Large stones may have to be removed from some sites. The shrinking and swelling can be overcome by replacing the upper layers with suitable soil material. The walls of shallow excavations in the Oshtemo and Leoni soils tend to cave in and, therefore, need to be reinforced.

This complex is in capability subclass IIIe and Michigan soil management groups 3a and Ga.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland, as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities, and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

Dwight L. Quisenberry, agronomist, Soil Conservation Service, assisted in preparing this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1977, according to the Michigan Agricultural Statistics (4), for the county, about 83,000 acres was planted to corn, of which about 15,000 acres was harvested for silage. About 12,000 acres was planted to wheat, about 4,800 acres was planted to oats, and about 2,400 acres was planted to soybeans. About 31,000 acres was used as hayland, of which about 17,000 acres was alfalfa. A number of specialty crops were also produced in 1977. The most common specialty crops were sod, onions, lettuce, celery, and mint. Small acreages of strawberries, blueberries, and apples were also harvested.

Food production in Jackson County could be increased by applying soil and water conservation practices and by extending the latest crop production technology to all the cropland in the county. This soil survey can help determine the conservation practices needed.

The soils and climate of the survey area are suited to some crops that are not commonly grown. Dry beans, grain sorghum, potatoes, sunflowers, buckwheat, barley, rye, and flax, for example, could be grown if economic conditions are favorable. Grass seed could be produced from bromegrass, fescue, and similar grasses. Other specialty crops that could be grown commercially in the county are sweet corn, tomatoes, asparagus, cucumbers, radishes, carrots, and other vegetables and small fruits.

Deep, well drained soils that warm early in spring are suited to many vegetables and small fruits. The nearly level and undulating Arkport, Boyer, Okee, Oshtemo, Ormas, and Spinks soils on uplands are examples.

The mucky soils, if adequately drained and protected from soil blowing, are suited to a wide range of vegetables. The very poorly drained Houghton, Palms, and Edwards soils and the very poorly drained Henrietta and Martisco soils are examples. The Napoleon soils are suited to blueberries and other crops that grow well on extremely acid soils.

Most of the well drained soils in the survey area are suited to orchard crops and nursery plants. Soils on low

positions, where frost is frequent and air drainage is poor, however, are generally poorly suited to early vegetables, small fruits, and orchard crops.

The latest information and suggestions for growing crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service

Most of the arable soils in the county respond well to nitrate, phosphate, and potash fertilizers. The organic soils may be deficient in the nutrients, especially micronutrients such as zinc, boron manganese, and copper, needed by some crops and should respond to micronutrient fertilizers. Many of the mineral soils may need periodic applications of ground limestone to raise their pH sufficiently for good growth of alfalfa and other crops that grow well only on slightly acid or neutral soils. On all soils the amount of lime and fertilizer used should be based on the results of soil tests, on the needs of the crop, and on the expected yield (*5*). The Cooperative Extension Service can help to determine the amount of fertilizer and lime to apply

Organic matter is an important source of nitrogen for crops It also promotes good soil tilth, reduces surface crusting, increases the available water capacity and water intake rate of the soil, and reduces erosion. Maintaining a high content of organic matter is a concern of management on most of the well drained to somewhat poorly drained soils that are used as cropland. Using a crop rotation that includes grasses and legumes, returning crop residue to the soil, and regularly adding other organic matter maintain or increase the organic matter content.

Maintaining good soil tilth is a concern of management on most of the somewhat poorly drained and poorly drained soils that are used as cropland. It is also a concern on the well drained Riddles, Saylesville, Marlette, Owosso, and Whalan soils. Working these soils when they are too wet results in compaction and the formation of clods. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields The compaction of the soil and the reduction in the content of organic matter in the soil increase the severity of surface crusting. Surface crusting hinders seedling emergence and increases runoff and erosion. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

Conserving soil moisture during dry periods is a concern of management on the Arkport, Boyer, Eleva, Leoni, Okee, Ormas, Oshtemo, and Spinks soils. Conservation tillage, which leaves much of the crop residue on the surface, helps to conserve soil moisture Increasing a soil's organic matter content increases its available water capacity. Irrigation increases crop yields and has become an important practice in the county in the last few years. The droughty soils and many other soils in the county are suited to irrigation if proper conservation and management practices are followed. The soil features that affect the design, layout, construction, management, and performance of irrigation systems are identified in table 14.

Soil erosion is a major hazard on most of the cropland in Jackson County. Soil erosion reduces the productivity of the soil by removing the surface layer, which contains most of the available plant nutrients and most of the organic matter. Soil erosion on farmland in many areas also results in the pollution of streams by sediment, nutrients, and pesticides. Controlling erosion is a concern of management on all of the soils that have slopes of 6 percent or more It is also a concern on Marlette-Owosso complex, 2 to 6 percent slopes; Riddles sandy loam, 2 to 6 percent slopes, Hillsdale-Riddles sandy loams, 1 to 6 percent slopes; Del Rey silt loam, 0 to 3 percent slopes; and Saylesville silt loam, 2 to 8 percent slopes

Erosion control practices provide a protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps a plant cover on the soil for extended periods reduces erosion and preserves the productive capacity of the soils. Legume and grass forage crops used in a cropping system reduce erosion on sloping land, provide nitrogen for other crops, and improve soil tilth. Conservation tillage used in a cropping system helps to control surface runoff and erosion. Cover crops, crop residue, and grassed waterways also help prevent erosion.

Soil blowing is a hazard on the sandy Arkport, Okee, Ormas, and Spinks soils and on the mucky Edwards, Henrietta, Houghton, Martisco, Napoleon, and Palms soils. Some of the loamy soils are also susceptible to soil blowing. Maintaining a plant cover, using surface mulch, planting buffer strips, and roughing the surface through tillage minimize soil blowing on these soils. Conservation tillage helps to control soil blowing by leaving crop residue on the surface. Vegetative barriers such as shrub and tree windbreaks also help to reduce soil blowing.

Some soils are naturally so wet that they are not suitable for use as cropland and pasture unless they are artificially drained These are the poorly drained Barry, Cohoctah, Colwood, Lenawee, and Sebewa soils and the very poorly drained Edwards, Gilford, Henrietta, Houghton, Martisco, Napoleon, Palms and Wauseon soils. The somewhat poorly drained Brady, Capac, Del Rey, Dixboro, Kibbie, Teasdale, and Ypsi soils also require artificial drainage for optimum crop yields.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface and subsurface drainage is needed in most areas of the somewhat poorly drained, poorly drained, and very poorly drained soils that are intensively row cropped. Finding adequate outlets for drainage systems is difficult in some areas.

Information on erosion control and drainage practices for each kind of soil can be obtained at the local office of the Soil Conservation Service

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates, suitable high-yielding crop varieties, appropriate and timely tillage, control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (*9*). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification to which a soil has been assigned is given at the end of the description of each soil in the section "Detailed soil map units."

Also given at the end of each description is a Michigan soil management group. The soils are assigned to a group according to need for lime and fertilizer and for artificial drainage and other practices. For soils making up a soil complex, the soil management groups are listed in the same order as the series named in the complex.

For a detailed explanation of the Michigan soil management groups see Michigan State University Extension Bulletin E-1262 (*6*).

woodland management and productivity

David J. Poe, forester, Soil Conservation Service, assisted in writing this section.

Virgin forest once covered almost all of the land in Jackson County, but the trees have been cleared from most of the land suitable for cultivation. In much of the remaining woodland the soils are too wet or too steep for farming. These soils produce trees of high quality if the woodland is managed properly.

Woodland now makes up about 115,000 acres, or about 25 percent, of the county. It is the dominant land use in associations 9 and 10 described in the section "General soil map units." Woodlots are scattered throughout the other soil associations in the county. On the upland soils mixed hardwoods, mainly red oak, black oak, white oak, bur oak, shagbark hickory, sugar maple, black cherry, and white ash, are the most common trees. In some areas of the upland soils, black walnut and sassafras are abundant. On the mineral soils in low-lying areas and on bottom lands, red maple, basswood, silver maple, cottonwood, sycamore, swamp white oak, green ash, and black ash are the most common trees. On the very poorly drained organic soils, tamarack, yellow birch, cottonwood, silver maple, red maple, swamp white oak, and black ash are the most common trees.

Much of the existing commercial woodland would benefit from thinning and other silvicultural practices such as the control of plant competition, disease, and insects. The Soil Conservation Service and Michigan Department of Natural Resources, Division of Forestry, can help determine specific woodland management needs.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on the soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops

from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

Charles M. Smith, wildlife biologist, Soil Conservation Service, assisted in writing this section.

The many water areas and approximately 17,000 acres of park and recreation land provide numerous opportunities for recreation.

There are 25 major public recreation areas and 13 campgrounds in the county. The Waterloo Recreation Area, in the northeastern part of the county, has approximately 10,000 acres of land and water suitable for hunting, fishing, boating, camping, hiking, horseback riding, and snowmobiling and other activities. The Sharonville State Game Area, about 5,000 acres in the southeastern part of the county, is used mainly for hunting. Fifteen county parks and approximately 17 public and private golf courses are scattered throughout the county. Of the more than 700 lakes and ponds in the county, many are adequate for swimming, fishing, and boating.

The use of recreation areas in the county has increased greatly in the past several years. Many soils are well suited to the development of recreation facilities.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife habitat

Charles M. Smith, wildlife biologist, Soil Conservation Service, assisted in writing this section.

Jackson County has a large and varied population of fish and wildlife. The wooded areas are habitat for white-tailed deer, tree squirrels, raccoon, hawks, owls, and many types of songbirds. The farmed areas are habitat for ring-necked pheasant, cottontail, woodchuck, fox, and songbirds. The streams and lakes support bluegill, perch, smallmouth bass, largemouth bass, northern pike, and carp. Some of the lakes and wetland areas are nesting and feeding areas for the sandhill crane and other waterfowl during the fall and spring migrations.

In many areas in the county the wildlife habitat can be improved by increasing the food, cover, water, and living space that the wildlife need. The soils that are best suited to wildlife habitat are scattered throughout the county, in all of the soil associations described in the section "General soil map units." The Waterloo Recreation Area, which is mainly in associations 9 and 10, and the Sharonville State Game area, which is mainly in association 7, provide important wildlife habitat.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are orchardgrass, timothy, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are ragweed, goldenrod, lambsquarters, dandelion, and strawberry.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, maple, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cattail, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, potholes, wet meadows, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include ring-necked pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include owls, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and opossum.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of

landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good*, *fair*, or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches

of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and bedrock.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone and soil reaction.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed

waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and *maintenance* of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (2) and the system adopted by the American Association of State Highway and Transportation Officials (1).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly

erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is

seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 17 shows the expected initial subsidence, which usually is a result of drainage, and annual subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*10*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquolls*, the suborder of the Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*8*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*10*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Arkport series

The Arkport series consists of deep, well drained, moderately rapidly permeable soils on moraines, lake plains, and outwash plains. These soils formed in stratified sandy glacial drift. The slope ranges from 2 to 25 percent.

The Arkport soils are similar to Okee and Spinks soils and are commonly adjacent to Dixboro, Hillsdale, Okee, and Riddles soils on the landscape. The Okee soils have more clay in the lower part of the solum than Arkport soils. The Spinks soils have less clay in the lamellae. The Dixboro soils are somewhat poorly drained and are

on lower positions on the landscape than the Arkport soils. The Hillsdale and Riddles soils contain more clay in the upper part of the solum. The Hillsdale, Okee, Riddles and Arkport soils are on similar positions on the landscape.

Typical pedon of Arkport loamy fine sand in an area of Arkport-Okee loamy fine sands, 2 to 6 percent slopes, 1,270 feet west and 2,400 feet north of the SE. corner of sec. 8, T. 4 S., R. 1 E., in Columbia Township:

Ap—0 to 8 inches, dark brown (10YR 4/3) loamy fine sand; weak fine granular structure; very friable, slightly acid abrupt smooth boundary.

A2—8 to 21 inches; yellowish brown (10YR 5/4) loamy fine sand; single grain, loose; slightly acid, abrupt wavy boundary.

A&B—21 to 62 inches; yellowish brown (10YR 5/6) loamy fine sand (A2); single grain; loose; many bands, 1/8 inch to 6 inches wide, of strong brown (7.5YR 5/6) fine sandy loam (B2t); weak medium subangular blocky structure; friable; slightly acid; abrupt irregular boundary.

C—62 to 66 inches; stratified yellowish brown (10YR 5/4) fine sand and very fine sand, single grain; loose; very friable; violent effervescence, moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 40 to 90 inches. The solum is 0 to 15 percent pebbles and is very strongly acid to neutral.

The Ap horizon has color value of 4 or 5 and chroma of 2 or 3. It is dominantly loamy fine sand, but the range includes fine sandy loam. The A2 horizon has color value of 5 or 6 and chroma of 4 or 6. It is sand, fine sand, loamy sand, or loamy fine sand. Some pedons do not have an A2 horizon.

The A part of the A&B horizon is similar in color and texture to the A2 horizon. The B part has color value of 5 or 6 and chroma of 4 or 6. It is fine sandy loam, sandy loam, or loamy fine sand.

The C horizon has color value of 5 or 6 and chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

Barry series

The Barry series consists of deep, poorly drained, moderately permeable soils on till plains and moraines. These soils formed in loamy glacial till. The slope is 0 to 2 percent.

The Barry soils are commonly adjacent to Palms, Riddles and Teasdale soils on the landscape. The Palms soils have an organic horizon 16 to 50 inches thick, are very poorly drained, and are on lower positions on the landscape than the Barry soils. The Riddles soils are well drained, and the Teasdale soils somewhat poorly drained. These soils are on higher positions on the landscape than the Barry soils.

Typical pedon of Barry loam, 530 feet north and 100 feet west of the SE corner of sec. 18, T. 2 S., R. 1 W., in Blackman Township

Ap—0 to 10 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry, moderate medium subangular blocky structure; friable; 4 percent pebbles; neutral abrupt smooth boundary.

B21tg—10 to 14 inches; dark olive gray (5Y 3/2) loam; few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure, friable, thick dark gray (10YR 4/1) and grayish brown (10YR 5/2) clay films on faces of peds; 4 percent pebbles; mildly alkaline; gradual smooth boundary.

B22tg—14 to 19 inches; dark gray (5Y 4/1) sandy clay loam; few fine prominent yellowish brown (10YR 5/6) mottles, strong medium subangular blocky structure; firm, thick very dark gray (5YR 3/1) clay films on faces of peds, 4 percent pebbles, mildly alkaline, gradual wavy boundary.

B23tg—19 to 26 inches; olive (5Y 5/3) sandy clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; thick very dark gray (5Y 3/1) clay films on faces of peds; 4 percent pebbles, mildly alkaline gradual wavy boundary.

B3g—26 to 30 inches; olive (5Y 5/3) sandy loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very friable; 4 percent pebbles; mildly alkaline; gradual smooth boundary.

C1g—30 to 44 inches; grayish brown (2.5Y 5/2) sandy loam; weak fine subangular blocky structure; very friable; 6 percent pebbles; strong effervescence, moderately alkaline; gradual wavy boundary.

C2g—44 to 60 inches; grayish brown (2.5Y 5/2) loamy sand; massive, very friable; 8 percent pebbles, strong effervescence, moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 24 to 48 inches. The mollic epipedon ranges in thickness from 10 to 15 inches and commonly includes part of the argillic horizon. Pebbles make up 1 to 5 percent of the solum and 3 to 15 percent of the C horizon. The solum ranges from slightly acid to mildly alkaline.

The Ap horizon has color value of 2 or 3 and chroma of 1 or 2. It ranges in thickness from 10 to 13 inches. It is dominantly loam, but the range includes sandy loam and silt loam.

The B2tg horizon has hue of 2.5Y, 5Y, or 10YR, value of 3 to 6, and chroma of 1 to 3. It is sandy loam, loam, sandy clay loam, or clay loam. Some pedons do not have a B3 horizon.

The C horizon has hue of 2.5Y, 5Y, or 10YR, value of 5 or 6, and chroma of 2 or 3. It is loamy sand, sandy loam, or fine sandy loam. It is mildly alkaline or moderately alkaline.

Boyer series

The Boyer series consists of deep, well drained soils that are moderately rapidly permeable in the solum and very rapidly permeable in the substratum. These soils are on outwash plains, valley trains, eskers, and moraines. They formed in sandy and loamy glaciofluvial deposits. The slope ranges from 1 to 40 percent.

The Boyer soils are similar to Eleva and Oshtemo soils and are commonly adjacent to Brady, Ormas, Oshtemo, and Spinks soils on the landscape. The Eleva soils are underlain by weathered sandstone at a depth of 20 to 40 inches. The Oshtemo soils have a thicker and more acid solum than the Boyer soils. The Brady soils are somewhat poorly drained and are on lower positions on the landscape than the Boyer soils. The Ormas soils have more than 20 inches of sandy material above the Bt horizon. The Spinks soils have less clay in the solum and have a B horizon that consists of lamellae. The Ormas, Oshtemo, Spinks, and Boyer soils are on similar positions on the landscape.

Typical pedon of Boyer sandy loam in an area of Boyer-Oshtemo sandy loams, 1 to 6 percent slopes, 2,165 feet north and 2,660 feet east of the SW. corner of sec. 7, T. 4 S., R. 2 E., in Columbia Township:

Ap—0 to 11 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; very friable; 5 percent pebbles; slightly acid; abrupt smooth boundary.

B21t—11 to 25 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; 5 percent pebbles; thin clay films; medium acid; clear wavy boundary.

B22t—25 to 31 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; 3 percent pebbles; clay bridging between sand grains; medium acid; abrupt wavy boundary.

B23t—31 to 34 inches; dark brown (7.5YR 4/4) gravelly sandy loam; moderate fine subangular blocky structure; friable; 20 percent pebbles; thick clay films; neutral; abrupt wavy boundary.

IIC—34 to 60 inches; yellowish brown (10YR 5/4) very gravelly sand; single grain; loose; 55 percent pebbles; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 22 to 40 inches. Pebbles make up 1 to 25 percent of the solum and 10 to 55 percent of the IIC horizon. The solum typically ranges from medium acid to neutral in the upper part and from slightly acid to mildly alkaline in the lower part.

The Ap horizon has color value of 3 to 5 and chroma of 2 or 3. It is dominantly sandy loam, but the range includes loamy sand. Some pedons have an A2 horizon. It has color value of 5 or 6 and chroma of 3 or 4. It is sandy loam or loamy sand.

A B1 horizon is in some pedons. The B2t horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 to 6, and chroma of 3 to 6. It is dominantly sandy loam or gravelly sandy loam, but in some pedons it has thin layers of fine sandy loam and sandy clay loam. Some pedons have a B3 horizon.

The IIC horizon has color value of 5 or 6 and chroma of 2 or 4. It is sand, gravelly sand, or very gravelly sand. It is mildly alkaline or moderately alkaline.

Brady series

The Brady series consists of deep, somewhat poorly drained soils that are moderately rapidly permeable in the upper part of the profile and very rapidly permeable in the lower part. These soils are on outwash plains, valley trains, and moraines. They formed in sandy and loamy glaciofluvial deposits. The slope ranges from 0 to 3 percent.

These soils have a lighter colored surface layer than is defined in the range for the Brady series, but this difference does not alter their use and behavior.

The Brady soils are similar to Dixboro and Teasdale soils and are commonly adjacent to Barry, Boyer, Colwood, Gilford, Oshtemo, and Spinks soils on the landscape. The Dixboro soils have a stratified sandy and loamy C horizon. The Teasdale soils have a loamy C horizon. The Boyer, Oshtemo, and Spinks soils are well drained and are on higher positions on the landscape than the Brady soils. The Colwood and Barry soils are poorly drained and are on lower positions on the landscape than the Brady soils. The Gilford soils are very poorly drained and are on lower positions on the landscape than the Brady soils.

Typical pedon of Brady sandy loam, 0 to 3 percent, 450 feet west and 675 feet south of the center of sec. 31, T. 3 S., R. 2 E., in Napoleon Township:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) sandy loam; moderate medium subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

A2—10 to 13 inches; brown (10YR 5/3) sandy loam; weak fine subangular blocky structure; very friable; slightly acid; clear wavy boundary.

B21t—13 to 22 inches; yellowish brown (10YR 5/4) sandy loam, few fine distinct grayish brown (10YR 5/2) and many fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; dark brown (7.5YR 4/4) stains, common medium dark brown (7.5YR 3/2) iron-manganese concretions, 2 percent pebbles; slightly acid, clear irregular boundary.

B22t—22 to 30 inches; yellowish brown (10YR 5/4) sandy loam; many fine distinct light grayish brown (10YR 6/2) and many medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; dark brown (7.5YR 4/4) iron-manganese stains; common medium dark brown (7.5YR 3/2) iron-manganese

concretions; 2 percent pebbles, slightly acid; clear irregular boundary.

B3—30 to 54 inches; yellowish brown (10YR 5/4) loamy sand; many fine distinct strong brown (7.5YR 5/6) and common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure; very friable; dark brown (7.5YR 4/4) stains few fine dark brown (7.5YR 3/2) iron-manganese concretions; neutral; 2 percent pebbles, clear wavy boundary.

IIC—54 to 60 inches; yellowish brown (10YR 5/4) sand; few fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; 5 percent pebbles; strong effervescence; moderately alkaline

The thickness of the solum and the depth to free carbonates typically are 45 to 55 inches, but the range is 40 to 70 inches. The solum is 0 to 20 percent pebbles and is strongly acid to neutral.

The Ap horizon has color value of 3 or 4 moist, and 6 or more dry, and chroma of 1 or 2. It is 8 to 12 inches thick The A2 horizon has color value of 5 or 6 and chroma of 2 or 3. The dominant texture of the A horizon is sandy loam, but the range includes loamy sand

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 6 It is dominantly sandy loam, but in some pedons it has thin layers of sandy clay loam and clay loam. Some pedons do not have a B3 horizon.

The C horizon has chroma of 2 to 4. It is sand or gravelly sand Reaction ranges from neutral to moderately alkaline.

Capac series

The Capac series consists of deep, somewhat poorly drained, moderately and moderately slowly permeable soils on till plains and moraines These soils formed in loamy glacial till. The slope ranges from 0 to 3 percent.

The Capac soils are similar to Marlette and Teasdale soils and are commonly adjacent to Barry, Marlette, and Owosso soils on the landscape. The Teasdale soils have less clay in the solum than the Capac soils. The Barry soils are poorly drained and are on lower positions on the landscape than the Capac soils. The Marlette and Owosso soils are well drained and are on higher positions on the landscape than the Capac soils.

Typical pedon of Capac loam 0 to 3 percent slopes, 100 feet south and 1,400 feet west of the NE. corner of sec. 8, T. 1 S., R. 3 W., in Springport Township:

Ap—0 to 8 inches. very dark grayish brown (10YR 3/2) loam, light brownish gray (2.5Y 6/2) dry, weak moderate subangular blocky structure friable, 3 percent pebbles; neutral abrupt smooth boundary

B&A 8 to 14 inches; dark yellowish brown (10YR 4/4) loam (B2); and yellowish brown (10YR 5/4) loam (A2) white (10YR 8/2) dry; common fine faint light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; 3 percent pebbles; neutral; clear smooth boundary.

B21t—14 to 21 inches, yellowish brown (10YR 5/4) loam; common medium faint pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; thin dark grayish brown (10YR 4/2) clay films on vertical faces of peds; 3 percent pebbles; neutral; clear smooth boundary

B22t—21 to 26 inches; dark yellowish brown (10YR 4/4) clay loam common medium distinct light brownish gray (10YR 6/2) mottles; strong medium subangular blocky structure; firm; thick dark brown (7.5YR 3/2) clay films in root channels and many medium dark brown (7.5YR 4/4) clay films on vertical faces of peds; 3 percent pebbles, neutral, clear smooth boundary.

B3—26 to 34 inches; yellowish brown (10YR 5/4) clay loam; many coarse prominent grayish brown (2.5Y 5/2) mottles, weak fine subangular blocky structure in upper part and massive in lower part; firm 3 percent pebbles; mildly alkaline, gradual smooth boundary

C—34 to 60 inches; light olive brown (2.5Y 5/6) loam, many medium prominent light brownish gray (10YR 6/2) mottles, massive, firm 5 percent pebbles, slight effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 26 to 40 inches The content of pebbles is 1 to 10 percent throughout. The solum ranges from medium acid to mildly alkaline

The Ap horizon has color value of 3 or 4 moist, and 6 or more dry, and chroma of 2 or 3. It is dominantly loam, but the range includes sandy loam. Some pedons have an A2 horizon that has color value of 5 or 6 and chroma of 1 or 2 This horizon is loam or sandy loam.

The A part of the B&A horizon is similar in color and texture to the A2 horizon. The B part is similar in color and texture to the B2t horizon

The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 6, and chroma of 2 to 6 It is clay loam, silty clay loam, or loam.

The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 6. It is loam or clay loam. It is mildly alkaline or moderately alkaline.

Cohoctah series

The Cohoctah series consists of deep, poorly drained, moderately rapidly permeable soils on flood plains. These soils formed in loamy alluvium The slope is 0 to 2 percent.

The Cohoctah soils are similar to Gilford soils and are commonly adjacent to Colwood, Gilford, Houghton, and Palms soils on the landscape. The Gilford soils have a regular decrease in organic matter with depth and have more gravel in the solum than the Cohoctah soils The Colwood soils have a regular decrease in organic matter

with depth and have more clay in the pedon. The Houghton soils have organic material more than 51 inches thick. The Palms soils have organic material 16 to 51 inches thick. The Gilford, Colwood, Houghton, Palms, and Cohoctah soils are on similar positions on the landscape.

Typical pedon of Cohoctah fine sandy loam, 2,515 feet west and 90 feet north of the center of sec. 35, T. 1 S., R. 1 W., in Rives Township

A11—0 to 7 inches, black (10YR 2/1) fine sandy loam, very dark grayish brown (10YR 3/2) dry; many fine prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure, very friable; mildly alkaline; abrupt smooth boundary.

A12—7 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark brown (10YR 3/3) dry; many fine prominent dark brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; very friable, mildly alkaline abrupt smooth boundary.

C1g—11 to 28 inches; dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) very fine sandy loam; many fine distinct dark brown (7.5YR 3/2) and many fine prominent dark brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; friable; mildly alkaline; clear smooth boundary.

C2g—28 to 40 inches; very dark gray (10YR 3/1) fine sandy loam, few fine distinct dark brown (7.5YR 3/2), few fine prominent dark brown (7.5YR 4/4), and few fine faint grayish brown (10YR 5/2) mottles; moderate coarse subangular blocky structure; friable; mildly alkaline clear smooth boundary.

C3g—40 to 60 inches; stratified black (10YR 2/1) silt loam and dark grayish brown (10YR 4/2) sand, many fine prominent yellowish brown (10YR 5/6) and many fine faint very dark grayish brown (10YR 3/2) mottles; massive; friable (silt loam); single grain, loose (sand); slight effervescence; mildly alkaline.

The solum is 10 to 13 inches thick. The content of pebbles ranges from 0 to 5 percent throughout. The solum ranges from slightly acid to mildly alkaline. The Cg horizon is mildly alkaline or moderately alkaline.

The A horizon has color value of 2 or 3 and chroma of 1 or 2. It is dominantly fine sandy loam but the range includes loam, sandy loam, and loamy sand.

The Cg horizon has hue of 10YR or 7.5YR and value of 2 to 6. It is dominantly sandy loam, fine sandy loam, or loam, but in some pedons it has thin strata of sand, loamy sand, loamy fine sand, and silt loam.

Colwood series

The Colwood series consists of deep, poorly drained, moderately permeable soils in depressional areas and drainageways on outwash plains, till plains, and lake plains. These soils formed in stratified sandy, loamy, and silty glaciofluvial deposits. The slope is 0 to 2 percent.

The Colwood soils are similar to Gilford and Sebewa soils and are commonly adjacent to Dixboro, Gilford, and Palms soils on the landscape. The Gilford soils contain less clay in the lower part of the solum and less clay and silt in the substratum than the Colwood soils and are on positions on the landscape similar to those of the Colwood soils. The Sebewa soils have a sandy or sandy-skeletal substratum. The Dixboro soils are somewhat poorly drained and on higher positions on the landscape than the Colwood soils. The Palms soils have organic material 16 to 51 inches thick and are on slightly lower positions on the landscape than the Colwood soils.

Typical pedon of Colwood silt loam in an area of Gilford-Colwood complex, 2,400 feet west and 135 feet south of the center of sec. 7, T. 4 S., R. 1 E., in Columbia Township:

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam; moderate medium subangular blocky structure; friable; neutral; abrupt smooth boundary.

A12—8 to 12 inches, very dark gray (10YR 3/1) very fine sandy loam common fine distinct yellowish brown (10YR 5/4) and common fine prominent brownish yellow (10YR 6/6) mottles; moderate fine subangular blocky structure; friable; mildly alkaline; clear wavy boundary.

B1g—12 to 16 inches; dark grayish brown (10YR 4/2) very fine sandy loam; many medium faint brown (10YR 5/3) and many medium distinct yellowish brown (10YR 5/4) mottles, moderate medium subangular blocky structure, friable; very dark gray (10YR 3/1) worm casts and channels; mildly alkaline; clear wavy boundary.

B2—16 to 22 inches; light olive brown (2.5Y 5/4) loam, many medium prominent dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; friable; very dark gray (10YR 3/1) worm casts and channels; mildly alkaline; abrupt wavy boundary.

B3—22 to 33 inches; mottled olive (5Y 5/3) and brownish yellow (10YR 6/6) stratified loamy fine sand, loamy very fine sand, fine sandy loam, and clay loam; massive; friable and firm; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) worm casts and worm and root channels, mildly alkaline; abrupt wavy boundary.

Cg—33 to 60 inches; gray (10YR 5/1) and light olive brown (2.5Y 5/4) stratified very fine sandy loam, loamy fine sand, silt loam, and silty clay loam, many medium prominent brownish yellow (10YR 6/8) dark grayish brown (2.5Y 4/2) and strong brown (7.5YR 5/6) mottles, massive; friable and firm; thin lense of silty clay; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 24 to 50 inches. The mollic

epipedon is 10 to 15 inches thick. The solum ranges from slightly acid to mildly alkaline.

The A horizon has color value of 2 or 3 and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam, very fine sandy loam, and sandy loam.

The B horizon has hue of 10YR, 7.5YR, 5Y, or 2.5Y and chroma of 1 to 8. It has many low-chroma mottles. It is clay loam, sandy clay loam, silty clay loam, silt loam, loam, very fine sandy loam, or fine sandy loam.

The C horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is stratified loamy very fine sand, fine sand, very fine sand, silt loam, silty clay loam, very fine sandy loam, or loamy sand. It is mildly alkaline or moderately alkaline.

Del Rey series

The Del Rey series consists of deep, somewhat poorly drained, slowly permeable soils on lake plains and terraces and in depressional areas on moraines. These soils formed in silty and clayey glaciolacustrine sediments. The slope ranges from 0 to 3 percent.

The Del Rey soils are similar to Saylesville soils and are commonly adjacent to Arkport, Lenawee, Okee, and Saylesville soils on the landscape. The Saylesville soils are well drained. The Arkport and Okee soils have more sand than the Del Rey soils. The Arkport, Okee, and Saylesville soils are on higher positions on the landscape than the Del Rey soils. The Lenawee soils are poorly drained and are on lower positions on the landscape than the Del Rey soils.

Typical pedon of Del Rey silt loam, 0 to 3 percent slopes, 1,440 feet south and 1,440 west of the NE. corner of sec. 25, T. 1 S., R. 2 E., in Waterloo Township:

Ap—0 to 9 inches, dark grayish brown (10YR 4/2) silt loam; weak medium subangular blocky structure; friable, 2 percent pebbles, neutral; abrupt smooth boundary.

B2t—9 to 24 inches; yellowish brown (10YR 5/4) silty clay; common fine distinct strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) and many fine distinct grayish brown (10YR 5/2) mottles, strong fine angular blocky structure; firm; continuous moderately thick olive gray (5Y 4/2) clay films on faces of peds; 1 percent pebbles; neutral; abrupt wavy boundary.

C—24 to 60 inches, yellowish brown (10YR 5/4) silty clay loam; many fine distinct grayish brown (10YR 5/2) and common fine prominent strong brown (7 YR 5/6) mottles; massive; firm; few light gray (10YR 7/2) calcium carbonate accumulations; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates typically are 24 to 36 inches, but the range is 24 to 48 inches. The content of pebbles ranges from 0 to 5 percent throughout. The solum ranges from strongly acid to neutral in the upper part and from slightly acid to moderately alkaline in the lower part.

The Ap horizon has color value of 3 or 4 moist, and 6 or more dry, and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam. Some pedons have an A2 horizon. It has color value of 4 to 6 and chroma of 1 or 2.

The B2t horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 4 to 6. It is silty clay or silty clay loam.

The C horizon is dominantly silty clay loam. In some pedons it is stratified, consisting of thin bands of sandy material and layers of silt loam, silty clay loam, or silty clay. It is mildly alkaline or moderately alkaline.

Dixboro series

The Dixboro series consists of deep, somewhat poorly drained, moderately permeable soils on lake plains and outwash plains. These soils formed in stratified sandy and loamy glaciofluvial deposits. The slope ranges from 0 to 3 percent.

These soils have a lighter colored surface layer and a thicker solum than defined for the Dixboro series, but these differences do not alter their use and behavior.

The Dixboro soils are similar to Brady and Kibbie soils and are commonly adjacent to Arkport, Colwood, Gilford, and Okee soils on the landscape. The Brady soils, unlike the Dixboro soils have a C horizon of coarse sand and gravel. The Kibbie soils have more clay in the Bt horizon. The Arkport and Okee soils are well drained and are on higher positions on the landscape than the Dixboro soils. The Colwood soils are poorly drained and are on lower positions on the landscape than the Dixboro soils. The Gilford soils are very poorly drained and are on lower positions on the landscape than the Dixboro soils.

Typical pedon of Dixboro very fine sandy loam, 0 to 3 percent slopes, 2,150 feet south and 100 feet east of the NW. corner of sec. 7, T. 4 S., R. 1 E., in Columbia Township:

Ap—0 to 9 inches; dark brown (10YR 4/3) very fine sandy loam; moderate fine subangular blocky structure; very friable; neutral; abrupt smooth boundary.

A2—9 to 17 inches; light yellowish brown (10YR 6/4) very fine sandy loam; common fine prominent strong brown (7.5YR 5/6) mottles, weak thick platy structure parting to weak medium subangular blocky; very friable; neutral, common wavy boundary.

B21t—17 to 25 inches; yellowish brown (10YR 5/4) very fine sandy loam; common medium prominent strong brown (7.5YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure, friable, common thin clay films on faces of peds and clay bridging between sand grains, neutral, abrupt smooth boundary.

B22t—25 to 36 inches; strong brown (7.5YR 5/6) silt loam; common medium prominent light gray (10YR 6/1) mottles; moderate medium subangular blocky structure; friable; few thin clay films; black (10YR 2/1) mineral stains; medium acid; abrupt smooth boundary.

B23t—36 to 52 inches; dark yellowish brown (10YR 4/4) sandy loam; few coarse distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; friable; clay bridging between sand grains; slightly acid; gradual wavy boundary.

B3—52 to 61 inches; dark yellowish brown (10YR 4/4) loamy sand; common coarse faint brown (10YR 5/3) and common coarse distinct strong brown (7.5YR 5/6) mottles; very friable; neutral; abrupt wavy boundary.

C—61 to 66 inches; stratified brown (10YR 5/3) silt loam and light yellowish brown (10YR 6/4) very fine sand; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 44 to 66 inches. The solum ranges from medium acid to neutral in the upper part and from slightly acid to mildly alkaline in the lower part.

The Ap horizon has color value of 3 or 4 moist, and 6 or more dry, and chroma of 2 or 3. It is dominantly very fine sandy loam, but the range includes fine sandy loam, sandy loam, loamy fine sand, and loamy very fine sand. The A2 horizon has color value of 5 or 6 and chroma of 3 or 4. It is similar in texture to the Ap horizon. Some pedons do not have an A2 horizon.

The B2t horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 3 to 6. It is fine sandy loam, loam, silt loam, sandy loam, or very fine sandy loam.

The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 to 4. It is stratified silt loam, very fine sand, very fine sandy loam, fine sandy loam, loamy very fine sand, or fine sand. In some pedons the C horizon contains strata of sand, silty clay loam, or silty clay. It is mildly alkaline or moderately alkaline.

Edwards series

The Edwards series consists of deep, very poorly drained, moderately slowly to moderately rapidly permeable organic soils in bogs and other depressional areas on glacial drainageways, outwash plains, lake plains, till plains, and moraines. These soils formed in decomposed herbaceous material over marl. The slope is 0 to 2 percent.

The Edwards soils are similar to Houghton and Martisco soils and are commonly adjacent to Houghton, Martisco, and Palms soils on the landscape. The Houghton soils have organic material more than 51 inches thick. The Martisco soils have less than 16 inches of organic material over marl. The Palms soils have organic material 16 to 50 inches thick over loamy mineral deposits. The Houghton, Martisco, and Palms soils are on topographic positions similar to those of the Edwards soils.

Typical pedon of Edwards muck, 1,900 feet east and 865 feet north of the SW corner of sec. 21, T. 3 S., R. 1 W., in Summit Township.

Oa1—0 to 12 inches, black (10YR 2/1) broken face and rubbed sapric material; about 20 percent fiber unrubbed, less than 5 percent rubbed; moderate medium granular structure, friable, primarily herbaceous fibers; less than 5 percent mineral material; few light gray (10YR 7/1) shell fragments, mildly alkaline, clear wavy boundary.

Oa2—12 to 28 inches; black (N 2/0) broken face and rubbed sapric material; about 30 percent fiber unrubbed, less than 5 percent rubbed; reddish brown (5YR 4/4) stains on faces of peds; moderate very coarse subangular blocky structure; firm, primarily herbaceous fibers; about 15 percent mineral material; few light gray (10YR 7/1) shell fragments; mildly alkaline; abrupt wavy boundary.

Lca1—28 to 36 inches; stratified grayish brown (10YR 5/2), gray (10YR 5/1), and light gray (10YR 7/1) marl; massive, friable; many light gray (10YR 7/1), white (10YR 8/2), and very pale brown (10YR 8/3) shells and shell fragments; black (10YR 2/1) root channels; violent effervescence; moderately alkaline; clear wavy boundary.

Lca2—36 to 60 inches; gray (5Y 6/1) marl; massive; friable, many light gray (10YR 7/1), white (10YR 8/2), and very pale brown (10YR 8/3) shells and shell fragments, common black (N 2/1) organic stains; violent effervescence, moderately alkaline.

The Lca horizon is at a depth of 16 to 49 inches. The organic material is primarily herbaceous, but in most pedons it has woody fragments throughout. It is typically mildly alkaline, but it ranges from medium acid to mildly alkaline.

The surface tier is typically sapric material, but the range includes hemic material.

In the subsurface tier the organic part has hue of 10YR, 7.5YR, or 5YR, value of 2 or 3, and chroma of 0 to 3. It is dominantly sapric material. In some pedons this tier contains less than 10 inches of hemic material. In some pedons it contains less than 2 inches of coprogeneous earth above the marl.

The Lca horizon has color value of 5 to 8 and chroma of 1 or 2. Reaction ranges from neutral to moderately alkaline. In some pedons the marl is underlain by mineral deposits at a depth of 51 to 60 inches.

Eleva series

The Eleva series consists of moderately deep, well drained and somewhat excessively drained, moderately and moderately rapidly permeable soils on till plains,

outwash plains, and moraines. These soils formed in residuum of sandstone or in loamy glacial drift over sandstone bedrock. The slope ranges from 1 to 12 percent.

The Eleva soils are similar to Eleva Variant and Hillsdale soils and are commonly adjacent to Eleva Variant, Hillsdale, and Riddles soils on the landscape. The Eleva Variant soils have more sandstone fragments in the pedon than the Eleva soils. The Hillsdale and Riddles soils are not underlain by sandstone between depths of 20 and 40 inches. The Eleva, Eleva Variant, Hillsdale, and Riddles soils are on similar positions on the landscape.

Typical pedon of Eleva sandy loam, 1 to 6 percent slopes, 390 feet east and 2,240 feet south of the NW. corner of sec. 23, T. 3 S., R. 2 W., in Spring Arbor Township:

Ap—0 to 10 inches; dark brown (10YR 4/3) sandy loam; weak very fine granular structure; friable; strongly acid; abrupt smooth boundary.

A2—10 to 16 inches; yellowish brown (10YR 5/4) sandy loam; moderate medium subangular blocky structure; friable; strongly acid; abrupt smooth boundary.

B21t—16 to 23 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; many thin brown (7.5YR 4/4) clay films on faces of peds; strongly acid; gradual wavy boundary.

B22t—23 to 29 inches; dark brown (7.5YR 4/4) sandy loam; moderate coarse subangular blocky structure; friable; strongly acid; clear wavy boundary.

IICr—29 to 45 inches; dark yellowish brown (10YR 4/4) weathered sandstone that breaks into channery loamy sand; fine faint strong brown (7.5YR 5/6), light yellowish brown (10YR 6/4), and light gray (10YR 7/1) mottles; weak coarse subangular blocky structure; very friable; 40 percent hard sandstone fragments; strongly acid; clear wavy boundary.

The thickness of the solum and the depth to weathered sandstone bedrock range from 20 to 40 inches. The depth to unweathered sandstone bedrock ranges from 40 to 60 inches. Pebbles and cobbles make up 0 to 15 percent of the solum. The pedon ranges from strongly acid to slightly acid.

The Ap horizon has color value of 3 to 5 and chroma of 2 or 3. Some pedons do not have an A2 horizon.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 5. It is dominantly sandy loam, but the range includes loam. Some pedons have a B3 or C1 horizon above the IICr horizon.

The sandstone bedrock has a wide color range.

Eleva Variant

The Eleva Variant consists of moderately deep, well drained, moderately rapidly permeable soils on till plains, outwash plains, and moraines. These soils formed in residuum of sandstone bedrock. The slope ranges from 15 to 30 percent.

The Eleva Variant soils are similar to Eleva soils and are commonly adjacent to Eleva, Hillsdale, and Riddles soils on the landscape. The Eleva soils have fewer sandstone fragments in the solum. The Hillsdale and Riddles soils do not have sandstone between depths of 20 and 40 inches. The Eleva Variant, Eleva, Hillsdale, and Riddles soils are on similar positions on the landscape.

Typical pedon of Eleva Variant channery fine sandy loam, 15 to 30 percent slopes, 2,600 feet west and 2,000 feet south of the NE. corner of sec. 31, T. 4 S., R. 2 W., in Hanover Township:

A1—0 to 4 inches; very dark brown (10YR 2/2) channery fine sandy loam; moderately fine granular structure; very friable; 40 percent sandstone fragments; very strongly acid; clear smooth boundary.

A2—4 to 6 inches; yellowish brown (10YR 5/4) channery fine sandy loam; weak fine platy structure; very friable; 50 percent sandstone fragments; very strongly acid; clear wavy boundary.

B2t—6 to 24 inches; yellowish brown (10YR 5/4) very channery sandy loam; weak fine subangular blocky structure; friable; clay bridging between sand grains; clay films in root channels; 55 percent sandstone fragments; very strongly acid; gradual wavy boundary.

Cr—24 to 42 inches; yellowish brown (10YR 5/6) weathered sandstone that breaks into channery sandy loam; massive; very friable; 70 percent hard sandstone fragments; very strongly acid; gradual wavy boundary.

The thickness of the solum and the depth to weathered sandstone bedrock range from 20 to 40 inches. Unweathered sandstone bedrock is at a depth of 20 to 60 inches. Coarse fragments make up 40 to 70 percent of the solum. The pedon ranges from very strongly acid to medium acid.

The A1 horizon has color value of 2 to 5 and chroma of 2 to 4. It ranges in thickness from 3 to 9 inches. Some pedons do not have an A2 horizon.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly very channery sandy loam, but the range includes very channery loam. Some pedons have a B3 horizon.

The Cr horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 5 to 8. Some pedons do not have a Cr horizon.

Gilford series

The Gilford series consists of deep, very poorly drained soils in depressional areas and drainageways on outwash plains, till plains, and lake plains. These soils

formed in loamy and sandy glaciofluvial deposits. Permeability is moderately rapid in the subsoil and rapid in the substratum. The slope is 0 to 2 percent.

The Gilford soils are similar to Cohoctah and Colwood soils and are commonly adjacent to Brady, Colwood, and Palms soils on the landscape. The Cohoctah soils have an irregular decrease in organic matter with depth. The Colwood soils have more clay in the lower part of the solum and more clay and silt in the substratum than the Gilford soils, and they are on similar positions on the landscape. The Brady soils are somewhat poorly drained and are on slightly higher positions on the landscape than the Gilford soils. The Palms soils have organic material 16 to 51 inches thick and are on slightly lower positions on the landscape than the Gilford soils.

Typical pedon of Gilford fine sandy loam in an area of Gilford-Colwood complex, 2,490 feet south and 1,600 feet west of the NE. corner of sec. 8, T. 1 S., R. 1 E., in Henrietta Township:

Ap—0 to 11 inches; black (10YR 2/1) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable, slightly acid; abrupt smooth boundary.

B21g—11 to 15 inches; grayish brown (2.5Y 5/2) fine sandy loam; common medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure, friable; slightly acid; clear wavy boundary.

B22g—15 to 23 inches; grayish brown (2.5Y 5/2) loam; common medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; neutral; clear wavy boundary.

B3—23 to 35 inches; stratified grayish brown (2.5Y 5/2) fine sandy loam and yellowish brown (10YR 5/8) loamy sand, common medium prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; massive; very friable; neutral gradual wavy boundary.

C1—35 to 50 inches, stratified grayish brown (2.5Y 5/2) sandy loam and loamy sand and sand, common medium faint grayish brown (10YR 5/2) and common medium prominent yellowish brown (10YR 5/8) mottles; massive very friable, mildly alkaline, gradual wavy boundary.

C2—50 to 60 inches, light olive brown (2.5Y 5/4) sand common medium distinct grayish brown (10YR 5/2) mottles, single grain; loose; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 20 to 40 inches. The mollic epipedon is 10 to 15 inches thick. The solum is 0 to 8 percent pebbles and is medium acid to neutral.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly fine sandy loam but the range includes loam, loamy fine sand, and sandy loam.

The B2g horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 or 2. It is dominantly fine sandy loam or loam, but in some pedons it has layers of sandy clay loam, sandy loam, and loamy sand.

In the C horizon, reaction ranges from neutral to moderately alkaline.

Henrietta series

The Henrietta series consists of deep, very poorly drained, moderately permeable soils in bogs and other depressional areas on glacial drainageways, outwash plains, lake plains, till plains, and moraines. These soils formed in less than 16 inches of decomposed herbaceous material and the underlying loamy glacial drift. The slope is 0 to 2 percent.

The Henrietta soils are similar to Palms soils and are commonly adjacent to Colwood, Gilford, and Palms soils on the landscape. The Palms soils have organic material 16 to 50 inches thick and are on positions on the landscape similar to those of the Henrietta soils. The Colwood and Gilford soils do not have a mucky surface layer, and they are on slightly higher positions on the landscape than the Henrietta soils.

Typical pedon of Henrietta muck, 1,800 feet south and 300 feet east of the NW. corner of sec. 26, T. 1 S., R. 1 E., in Henrietta Township:

Oap—0 to 12 inches, black (N 2/0) broken face and rubbed sapric material; about 3 percent fiber; moderate fine subangular blocky structure; very friable, primarily herbaceous fibers; medium acid; abrupt smooth boundary.

B21g—12 to 18 inches; light brownish gray (10YR 6/2) loamy fine sand; common fine prominent yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; very friable; common black (N 2/0) sapric material in large (1/8 to 1/4 inch diameter) root channels, about 3 percent pebbles; slightly acid; clear wavy boundary.

B22g—18 to 33 inches; stratified gray (10YR 6/1) silt loam and fine sandy loam and light brownish gray (10YR 6/2) fine sand; moderate medium subangular blocky structure; friable (silt loam and fine sandy loam parts); single grain, loose (fine sand part); common black (N 2/0) sapric material in large (1/8 to 1/4 inch diameter) root channels; about 3 percent pebbles; neutral; gradual wavy boundary.

B23g—33 to 43 inches; stratified gray (10YR 6/1) silt loam and fine sandy loam; many medium prominent light olive brown (2.5Y 5/4) mottles, moderate coarse subangular blocky structure; friable; common black (N 2/0) sapric material in large (1/8 to 1/4 inch diameter) root channels; about 3 percent pebbles, mildly alkaline; gradual wavy boundary.

Cg—43 to 60 inches; light brownish gray (10YR 6/2) loamy fine sand; massive; very friable, thin layer of silt loam and fine sandy loam slight effervescence; moderately alkaline.

The solum is 20 to 50 inches thick. The histic epipedon is 8 to 15 inches thick. In the mineral horizons the content of pebbles ranges from 0 to 15 percent. The solum ranges from medium acid to mildly alkaline.

The Oap horizon has hue of 10YR, 7.5YR, or 5YR, value of 2 or 3, and chroma of 0 to 3.

The B2g horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is dominantly loamy fine sand, silt loam, and fine sandy loam, but in some pedons it has strata of sandy clay loam, silt loam, sandy loam, loamy sand, fine sand, or sand.

The Cg horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is loamy fine sand or stratified silt loam, loam, sandy loam, fine sandy loam, loamy fine sand, or sand.

Hillsdale series

The Hillsdale series consists of deep, well drained, moderately permeable soils on till plains and moraines. These soils formed in loamy glacial till. The slope ranges from 1 to 30 percent.

The Hillsdale soils are similar to Eleva and Oshtemo soils and are commonly adjacent to Arkport, Okee, and Riddles soils on the landscape. The Eleva soils have sandstone between 20 and 40 inches. The Oshtemo soils have a sand and gravel substratum. The Arkport soils have more sand in the solum than the Hillsdale soils and have a B horizon that consists of lamellae. The Okee soils have more than 20 inches of sandy material above the B2 horizon. The Riddles soils have more clay in the B2t horizon than the Hillsdale soils. The Hillsdale, Arkport, Okee, and Riddles soils are on similar positions on the landscape.

Typical pedon of Hillsdale sandy loam in an area of Hillsdale-Riddles sandy loams, 1 to 6 percent slopes, 1,170 feet west and 1,000 feet north of the SE. corner of sec. 10, T. 4 S., R. 1 W., in Liberty Township:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) sandy loam, weak fine subangular blocky structure; very friable, 2 percent pebbles; slightly acid; abrupt smooth boundary.

A2—10 to 15 inches; brown (10YR 5/3) sandy loam; weak fine platy structure; very friable; 2 percent pebbles; slightly acid; gradual wavy boundary.

B21t—15 to 20 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; thin clay films on faces of peds; 2 percent pebbles, medium acid; gradual wavy boundary.

B22t—20 to 29 inches, dark brown (10YR 4/3) sandy loam; moderate medium subangular blocky structure, firm; thin clay films on faces of peds; 2 percent pebbles; medium acid; gradual wavy boundary.

B23t—29 to 35 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure, firm; thin clay films on faces of peds, 2 percent pebbles; medium acid; gradual wavy boundary.

B31—35 to 44 inches; dark yellowish brown (10YR 4/6) sandy loam; weak fine subangular blocky structure; friable; 2 percent pebbles; medium acid; gradual wavy boundary.

B32—44 to 63 inches; yellowish brown (10YR 5/6) sandy loam; weak fine subangular blocky structure; friable; 2 percent pebbles; medium acid; gradual wavy boundary.

C—63 to 66 inches; yellowish brown (10YR 5/4) sandy loam; massive; friable; 5 percent pebbles; slight effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates typically are 45 to 65 inches, but the range is 40 to 80 inches. The content of pebbles ranges from 2 to 15 percent throughout. The solum ranges from slightly acid to strongly acid.

The Ap horizon has color value of 3 to 4 and chroma of 1 to 3. It is dominantly sandy loam, but the range includes fine sandy loam, loamy sand, and loam. The A2 horizon has color value of 5 or 6. Some pedons do not have an A2 horizon.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6.

The C horizon has color value of 5 or 6 and chroma of 3 or 4. It is dominantly sandy loam, but the range includes loamy sand. It is mildly alkaline or moderately alkaline.

Houghton series

The Houghton series consists of deep, very poorly drained, moderately slowly to moderately rapidly permeable organic soils. These soils formed in decomposed herbaceous material in bogs and other depressional areas on glacial drainageways, outwash plains, lake plains, till plains, and moraines. The slope is 0 to 2 percent.

The Houghton soils are similar to Edwards and Palms soils and are commonly adjacent to Colwood, Edwards, Gilford, and Palms soils on the landscape. The Edwards soils have marl at a depth of 16 to 50 inches. The Palms soils have loamy mineral horizons at a depth of 16 to 50 inches. The Houghton, Edwards, and Palms soils are on similar positions on the landscape. The Colwood and Gilford soils do not have organic horizons and are on slightly higher positions on the landscape than the Houghton soils.

Typical pedon of Houghton muck, 150 feet east and 250 feet south of the center of sec. 27, T. 3 S., R. 1 W., in Summit Township:

Oap—0 to 10 inches; black (10YR 2/1) broken face, black (N 2/0) rubbed sapric material; about 10 percent fiber, unrubbed, and less than 5 percent,

rubbed; weak medium subangular blocky structure parting to moderate fine granular; very friable; primarily herbaceous fibers, about 5 percent mineral material; neutral; abrupt smooth boundary.

Oa2—10 to 17 inches; black (N 2/0) broken face and rubbed sapric material; about 5 percent fiber, unrubbed, and less than 5 percent, rubbed; dark reddish brown (5YR 3/2) stains on faces of peds; moderate coarse subangular blocky structure, firm, primarily herbaceous fibers; about 5 percent mineral material; neutral; abrupt wavy boundary.

Oa3—17 to 22 inches, black (N 2/0) broken face and rubbed sapric material; about 25 percent fiber, unrubbed, and less than 5 percent, rubbed; massive, very friable; primarily herbaceous fibers; about 5 percent mineral material, neutral; abrupt smooth boundary.

Oa4—22 to 34 inches, black (N 2/0) broken face and rubbed sapric material; about 35 percent fiber, unrubbed, and about 5 percent, rubbed; massive; very friable; primarily herbaceous fibers; about 5 percent mineral material, slightly acid; abrupt smooth boundary.

Oa5—34 to 60 inches; black (N 2/0) broken face and rubbed sapric material; about 15 percent fiber, unrubbed, and about 5 percent, rubbed, massive; very friable; primarily herbaceous fibers; about 5 percent mineral material; thin (1/4 to 1/2 inch) layer of gray (10YR 6/1) marl; neutral.

The organic material is more than 51 inches thick. It is primarily herbaceous, but in many pedons it has woody fragments throughout. It has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 0 to 3. Reaction ranges from medium acid to moderately alkaline.

The surface tier is typically sapric material, but the range includes hemic material.

The subsurface tier and the bottom tier are dominantly sapric material. In some pedons these tiers contain less than 10 inches of hemic material or less than 2 inches of limnic material. In some pedons a mineral horizon is at a depth of 51 to 60 inches.

Kibbie series

The Kibbie series consists of deep, somewhat poorly drained, moderately permeable soils on lake plains and outwash plains. These soils formed in stratified sandy, loamy, and silty glaciofluvial deposits. The slope ranges from 0 to 3 percent.

These soils have a lighter colored surface layer than is defined in the range for the Kibbie series, but this difference does not alter their use and behavior.

The Kibbie soils are similar to Dixboro soils and are commonly adjacent to Colwood, Dixboro, and Gilford soils on the landscape. The Dixboro soils have less clay in the solum and are on positions on the landscape similar to those of the Kibbie soils. The Colwood soils are poorly drained and are on slightly lower positions on the landscape than the Kibbie soils. The Gilford soils are very poorly drained and are on slightly lower positions in the landscape than the Kibbie soils.

Typical pedon of Kibbie fine sandy loam, 0 to 3 percent slopes, 1,080 feet west and 1,095 feet north of the SE. corner of sec. 33, T. 3 S., R. 1 W., in Summit Township:

Ap—0 to 9 inches, dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak coarse subangular blocky structure, very friable; slightly acid; abrupt smooth boundary.

B21t—9 to 18 inches; yellowish brown (10YR 5/4) clay loam; common medium faint dark brown (10YR 4/3) mottles, moderate medium subangular blocky structure; firm; many thick brown (10YR 5/3) and few thick light brownish gray (2.5Y 6/2) clay films on faces of peds; 2 percent pebbles; slightly acid; clear wavy boundary.

B22t—18 to 27 inches; light olive brown (2.5Y 5/4) fine sandy loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure, friable, few thin light olive brown (2.5Y 5/6) clay films on faces of peds, few strata of sandy clay loam; slightly acid; gradual wavy boundary.

B3—27 to 35 inches; light olive brown (2.5Y 5/4) very fine sandy loam and loamy fine sand; few fine distinct dark reddish brown (5YR 3/4), many coarse faint light yellowish brown (2.5Y 6/4), and many coarse prominent yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable, slightly acid; gradual wavy boundary.

C—35 to 60 inches; brown (10YR 5/3) and light olive brown (2.5Y 5/4) stratified very fine sandy loam, fine sand, and silt loam, many medium and coarse prominent grayish brown (2.5Y 5/2), light olive yellow (2.5Y 6/6), and light olive gray (5Y 6/2) mottles; weak fine platy structure; very friable; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates typically are 30 to 42 inches, but the range is 24 to 48 inches. The content of pebbles is less than 5 percent throughout. The solum ranges from medium acid to neutral.

The Ap horizon has color value of 4 moist, and 6 or more dry, and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes loam and loamy fine sand. Some pedons have an A2 horizon.

The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is dominantly clay loam or fine sandy loam, but in some pedons it has strata of loam, very fine sandy loam, and silt loam. Some pedons do not have a B3 horizon.

The C horizon has color value of 5 or 6 and chroma of 3 or 4. It ranges from silt loam to fine sand. It is mildly alkaline or moderately alkaline.

Lenawee series

The Lenawee series consists of deep, poorly drained, moderately slowly permeable soils on lake plains, terraces, and old glacial drainageways and in depressional areas on moraines. These soils formed in silty and clayey glaciolacustrine sediments The slope is 0 to 2 percent.

The Lenawee soils are commonly adjacent to Del Rey, Palms and Saylesville soils on the landscape. The Del Rey soils are somewhat poorly drained. The Saylesville soils are well drained. The Del Rey and Saylesville soils are on slightly higher positions on the landscape than the Lenawee soils. The Palms soils have organic material 16 to 50 inches thick and are on slightly lower positions on the landscape.

Typical pedon of Lenawee silt loam, 2,400 feet south and 400 feet west of the NE. corner of sec. 8, T. 1 S., R. 1 E., in Henrietta Township

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; friable; neutral; abrupt smooth boundary.

B21g—9 to 14 inches; grayish brown (10YR 5/2) silty clay loam, common fine prominent strong brown (7.5YR 5/6) and few fine faint gray (10YR 5/1) mottles, moderate medium subangular blocky structure; firm; neutral; clear wavy boundary.

B22g—14 to 34 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium prominent strong brown (7.5YR 5/6) and common fine distinct gray (10YR 6/1) mottles; strong medium subangular blocky structure; firm, neutral; clear wavy boundary

B23g—34 to 38 inches; gray (10YR 6/1) silty clay loam with strata, 1/8 to 1/2 inch thick, of very fine sand and silt loam; many medium prominent strong brown (7.5YR 5/6) mottles, moderate medium subangular blocky structure; firm; mildly alkaline; clear wavy boundary

Cg—38 to 60 inches; stratified yellowish brown (10YR 5/4) silt loam, silty clay loam, and very fine sand, many medium distinct gray (10YR 5/1) and common fine distinct strong brown (7.5YR 5/6) mottles, massive; firm; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 25 to 50 inches. The solum ranges from medium acid to neutral in the upper part and from slightly acid to mildly alkaline in the lower part.

The Ap horizon has color value of 2 or 3 and chroma of 1 or 2. It is dominantly silt loam, but the range includes silty clay loam and loam.

The B2g horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam, silty clay or clay loam with strata of silt loam, clay, or very fine sand.

The Cg horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 1 to 6 It is similar in texture to the B horizon. It is mildly alkaline or moderately alkaline.

Leoni series

The Leoni series consists of deep, well drained soils on moraines, eskers, kames, valley trains, and outwash plains. These soils formed in gravelly and cobbly loamy glaciofluvial deposits and in the underlying gravelly and cobbly sandy deposits. Permeability is moderate in the upper part of the subsoil and rapid or moderately rapid in the substratum. The slope ranges from 2 to 40 percent

The Leoni soils are commonly adjacent to the Boyer, Oshtemo, and Riddles soils on the landscape. The Boyer and Oshtemo soils have less clay and coarse fragments in the Bt horizon. The Riddles soils have less coarse fragments in the Bt horizon. The Leoni, Boyer, Oshtemo, and Riddles soils are on similar positions on the landscape.

Typical pedon of Leoni gravelly sandy loam, 2 to 6 percent slopes, 460 feet south and 2,240 feet east of the NW. corner of sec. 23, T. 2 S., R. 1 W., in Blackman Township.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) gravelly sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; 20 percent pebbles; medium acid; abrupt smooth boundary.

A2—11 to 13 inches; dark brown to brown (7.5YR 4/4) gravelly sandy loam; moderate medium subangular blocky structure; friable; 25 percent pebbles; neutral; clear wavy boundary.

B21t—13 to 18 inches; dark brown to brown (7.5YR 4/4) gravelly sandy clay loam; moderate medium subangular blocky structure, firm; discontinuous thin clay films on faces of peds and on coarse fragments; 35 percent pebbles, 3 percent cobblestones; slightly acid; gradual wavy boundary.

B22t—18 to 29 inches, dark brown to brown (7.5YR 4/4) gravelly sandy loam; moderate medium subangular blocky structure; firm; continuous thin clay films on faces of peds and on coarse fragments; 30 percent pebbles, 10 percent cobblestones; neutral, clear wavy boundary.

B3—29 to 42 inches, dark brown to brown (7.5YR 4/4) gravelly sandy loam; weak medium subangular blocky structure; friable; 35 percent pebbles, 3 percent cobblestones; neutral; abrupt irregular boundary.

C—42 to 60 inches; dark yellowish brown (10YR 4/4) very gravelly loamy sand; single grain, loose; 75 percent pebbles, 5 percent cobblestones, slight effervescence, moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 32 to more than 66 inches.

Pebbles and cobbles make up 15 to 40 percent of the A horizon and 35 to 75 percent of the B horizon. The solum ranges from medium acid to mildly alkaline

The Ap horizon has color value of 3 or 4 and chroma of 2 or 3. It is dominantly gravelly or cobbly sandy loam, but the range includes gravelly or cobbly loam. Some undisturbed areas have an A1 horizon that ranges in thickness from 1 to 5 inches.

The B2t horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 4 to 6. It is gravelly or cobbly sandy clay loam, clay loam, or sandy loam.

The C horizon has color value of 4 to 6 and chroma of 2 to 4. It is gravelly or cobbly sand, loamy sand, or sandy loam It is mildly alkaline or moderately alkaline.

Marlette series

The Marlette series consists of deep, well drained, moderately and moderately slowly permeable soils on till plains and moraines. These soils formed in loamy glacial till. The slope ranges from 2 to 12 percent.

The Marlette soils are similar to Capac soils and are commonly adjacent to Capac, Owosso, and Riddles soils on the landscape. The Capac soils are somewhat poorly drained and are on lower positions on the landscape than the Marlette soils. The Owosso soils have less clay in the upper part of the solum than the Marlette soils. The Riddles soils have a thicker solum than the Marlette soils and do not have the interfingering of the A horizon into the B horizon. The Marlette, Owosso, and Riddles soils are on similar positions on the landscape.

Typical pedon of Marlette loam in an area of Marlette-Owosso complex, 6 to 12 percent slopes, 2,500 feet east and 1,450 feet south of the NW. corner of sec 3, T 1 S., R. 3 W., in Springport Township:

Ap—0 to 8 inches dark brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; 5 percent pebbles; neutral; abrupt smooth boundary

B&A—8 to 12 inches; dark yellowish brown (10YR 4/4) clay loam (B2); coatings of brown (10YR 5/3) loam (A2), white (10YR 8/2) dry, more than 2 millimeters thick, on faces of peds; strong moderate subangular blocky structure; firm; few thin brown (7.5YR 4/4) clay films on faces of peds, 5 percent pebbles, slightly acid; clear wavy boundary.

B21t—12 to 28 inches; dark yellowish brown (10YR 4/4) clay loam, strong moderate subangular blocky structure, firm; thick continuous brown (7.5YR 4/4) clay films on faces of peds; 5 percent pebbles; slightly acid; clear wavy boundary

B22t—28 to 32 inches, dark yellowish brown (10YR 4/4) clay loam weak coarse subangular blocky structure; firm 5 percent pebbles, many thin discontinuous brown (7.5YR 4/4) clay films; mildly alkaline abrupt wavy boundary.

C—32 to 60 inches, brown (10YR 5/3) loam; massive, firm 5 percent pebbles, strong effervescence; mildly alkaline

The thickness of the solum and the depth to free carbonates range from 25 to 40 inches. The content of pebbles and cobbles ranges from 2 to 10 percent throughout. In the solum, reaction ranges from medium acid to neutral in the upper part and from slightly acid to mildly alkaline in the lower part

The Ap horizon has color value of 3 to 5 and chroma of 2 or 3. It is dominantly loam, but the range includes sandy loam. Some pedons have an A2 horizon that has color value of 5 or 6 and chroma of 2 or 3 This horizon is loam or sandy loam.

In the B&A horizon the A part is similar in color and texture to the A2 horizon. The B part is similar in color and texture to the B2t horizon

The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly clay loam, but the range includes silty clay loam.

The C horizon has color value of 4 to 6 and chroma of 2 or 3. It is mildly alkaline or moderately alkaline

Martisco series

The Martisco series consists of very poorly drained soils that formed in less than 16 inches of decomposed herbaceous material over marl. These soils are in bogs and other depressional areas on glacial drainageways, outwash plains, lake plains, till plains, and moraines. Permeability is moderate or moderately rapid in the organic material and slow in the substratum. The slope is 0 to 1 percent

The Martisco soils are similar to Edwards soils and are commonly adjacent to Edwards and Palms soils on the landscape The Palms soils consist of organic material 16 to 50 inches thick over loamy material. The Edwards soils have organic material 16 to 50 inches thick over marl. The Martisco, Edwards, and Palms soils are on similar topographic positions on the landscape

Typical pedon of Martisco muck, 910 feet north and 660 feet west of the center of sec. 29 T. 3 S., R. 1 W., in Summit Township:

Oa1—0 to 8 inches, black (10YR 2/1) broken face and rubbed sapric material; less than 1 percent fiber; moderate medium granular structure; friable; primarily herbaceous fibers; about 25 percent mineral material; few light gray (10YR 7/2) shells and shell fragments; violent effervescence; moderately alkaline, abrupt smooth boundary.

Lca1—8 to 15 inches, light gray (10YR 7/1) and white (10YR 8/1) marl; common medium distinct very pale brown (10YR 7/4) and prominent yellow (10YR 7/6) mottles weak coarse subangular blocky structure, friable; few light gray (10YR 7/1) shells and shell fragments; few dark gray (10YR 4/1) organic stains, violent effervescence; moderately alkaline; gradual wavy boundary.

Lca2—15 to 40 inches; gray (10YR 6/1) and white (10YR 8/1) marl; low fine prominent yellow (10YR

7/6) mottles; massive; friable; few light gray (10YR 7/1) shells and shell fragments, few black (10YR 2/1) organic stains; violent effervescence; moderately alkaline; gradual wavy boundary.

Lca3—40 to 60 inches; gray (10YR 5/1) and light gray (10YR 6/1) marl; massive; friable; few light gray (10YR 7/1) shells and shell fragments; violent effervescence; moderately alkaline

The depth to the Lca horizon and the thickness of the histic epipedon range from 8 to 15 inches. In the Oa1 horizon, reaction ranges from slightly acid to moderately alkaline. In the Lca horizon, reaction ranges from neutral to moderately alkaline. In some pedons the marl is underlain by mineral deposits at a depth of more than 32 inches.

Napoleon series

The Napoleon series consists of deep, very poorly drained, moderately and moderately rapidly permeable organic soils in bogs and other depressional areas on glacial drainageways, outwash plains, lake plains, till plains, and moraines. These soils formed in decomposed herbaceous material. The slope is 0 to 2 percent.

The Napoleon soils are commonly adjacent to Arkport, Okee, and Palms soils on the landscape. The Arkport and Okee soils do not have an organic horizon, are well drained, and are on higher positions on the landscape than the Napoleon soils. The Palms soils have 16 to 50 inches of mucky material over loamy material and are less acid than the Napoleon soils. The Palms and Napoleon soils are on similar positions on the landscape.

Typical pedon of Napoleon muck, 1,310 feet south of the NE corner of sec 8, T. 4 S., R. 1 E., in Columbia Township:

Oa1—0 to 5 inches; black (N 2/0) broken face and rubbed sapric material; about 5 percent fiber unrubbed, 2 percent rubbed; moderate fine granular structure; very friable; primarily herbaceous fibers; about 5 percent mineral material; extremely acid (pH 4.0 in calcium chloride); clear smooth boundary.

Oa2—5 to 10 inches; dark brown (7.5YR 3/2) broken face, very dark brown (10YR 2/2) rubbed sapric material; about 40 percent fiber unrubbed, about 10 percent rubbed, weak medium platy structure; friable; primarily herbaceous fibers; less than 5 percent mineral material; extremely acid (pH 4.0 in calcium chloride); clear smooth boundary.

Oe1—10 to 26 inches; dark brown (7.5YR 4/4) broken face, very dark brown (10YR 2/2) rubbed hemic material; about 80 percent fiber unrubbed, about 25 percent rubbed; weak thick platy structure; friable; primarily herbaceous fibers; less than 5 percent mineral material; extremely acid (pH 4.2 in calcium chloride), gradual smooth boundary.

Oe2—26 to 60 inches; dark brown (10YR 3/3) broken face, very dark brown (10YR 2/2) rubbed hemic material; about 60 percent fiber unrubbed, about 20 percent rubbed; massive, friable; primarily herbaceous fibers; less than 5 percent mineral material, extremely acid (pH 4.4 in calcium chloride).

The organic material is more than 51 inches thick. It is primarily herbaceous, but in many pedons it has woody fragments throughout. Some pedons have sphagnum moss up to 6 inches thick on the surface.

The surface tier is typically sapric material, but the range includes hemic material.

The subsurface tier and the bottom tier are dominantly hemic material. They have hue of 5YR, 7.5YR, or 10YR, value of 2 to 5, and chroma of 1 to 4. In some pedons these tiers contain less than 10 inches of sapric material.

In some pedons mineral horizons are at a depth of 51 to 60 inches.

Okee series

The Okee series consists of deep, well drained soils that are moderately rapidly permeable in the surface and subsurface layers and modertely permeable in the subsoil and substratum. These soils are on moraines and till plains. They formed in sandy and loamy glacial drift. The slope ranges from 2 to 25 percent.

The Okee soils are similar to Arkport and Ormas soils and are commonly adjacent to Arkport, Dixboro, Hillsdale, and Riddles soils on the landscape. The Arkport soils have a B horizon that consists of lamellae. The Ormas soils have less clay in the lower part of the solum and in the substratum. The Hillsdale and Riddles soils have more clay throughout the pedon. The Ormas, Arkport, Hillsdale, and Riddles soils are well drained and are on positions on the landscape similar to those of the Okee soil. The Dixboro soils are somewhat poorly drained and are on lower positions on the landscape than the Okee soils.

Typical pedon of Okee loamy fine sand in an area of Arkport-Okee loamy fine sands, 2 to 6 percent slopes, 1,720 feet east and 400 feet north of the SW corner of sec. 17, T. 4 S., R. 2 W., in Hanover Township:

Ap—0 to 8 inches; dark brown (10YR 4/3) loamy fine sand; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.

A2—8 to 24 inches; yellowish brown (10YR 5/6) loamy fine sand; weak fine subangular blocky structure, very friable; medium acid; gradual smooth boundary.

B21t—24 to 40 inches; dark yellowish brown (10YR 4/6) sandy loam; moderate coarse subangular blocky structure, few thin clay films on faces of peds; friable; medium acid; clear wavy boundary.

B22t—40 to 52 inches, dark yellowish brown (10YR 4/4) sandy loam; many thin dark brown (7.5YR 4/4) clay films on faces of peds; moderate coarse subangular blocky structure, friable; 10 percent pebbles; medium acid; clear wavy boundary.

B3—52 to 58 inches; dark brown (10YR 4/3) loamy sand; moderate fine subangular blocky structure; very friable; 10 percent pebbles; medium acid; abrupt wavy boundary.

IIC—58 to 66 inches; yellowish brown (10YR 5/4) sandy loam; massive; very friable; 15 percent pebbles; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to 60 inches. Coarse fragments make up 0 to 10 percent of the solum and 0 to 30 percent of the IIC horizon. The solum ranges from medium acid to neutral in the upper part and from medium acid to mildly alkaline in the lower part.

The Ap horizon has color value of 3 to 5 and chroma of 2 to 4. It is dominantly loamy fine sand, but the range includes loamy sand.

The A2 horizon has color value and chroma of 4 to 6. It is sand, loamy sand, or loamy fine sand.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is sandy clay loam, sandy loam, or loam.

The IIC horizon has color value of 5 or 6 and chroma of 3 or 4. It is sandy loam or loamy sand. It is mildly alkaline or moderately alkaline.

Ormas series

The Ormas series consists of deep, well drained soils that are moderately rapidly permeable in the solum and very rapidly permeable in the substratum. These soils are on moraines, eskers, outwash plains, and till plains. They formed in sandy and loamy glacial drift. The slope ranges from 0 to 25 percent.

The Ormas soils are similar to Okee soils and are commonly adjacent to Boyer, Oshtemo, and Spinks soils on the landscape. The Okee soils have more clay in the substratum than the Ormas soils. The Boyer and Oshtemo soils have more clay in the upper 20 inches of the pedon. The Spinks soils have a B horizon that consists of lamellae. The Boyer, Oshtemo, Spinks, and Ormas soils are on similar positions on the landscape.

Typical pedon of Ormas loamy sand in an area of Ormas-Spinks complex, 0 to 6 percent slopes, 1,700 feet west of the center of sec. 10, T. 4 S., R. 2 E., in Norvell Township:

Ap—0 to 11 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; very friable; 5 percent pebbles; neutral; abrupt smooth boundary.

A2—11 to 21 inches; yellowish brown (10YR 5/4) loamy sand; weak fine subangular blocky structure; very friable; 5 percent pebbles; neutral; abrupt wavy boundary.

B21t—21 to 26 inches; dark brown (7.5YR 4/4) sandy loam; moderate fine subangular blocky structure; friable; 5 percent pebbles; common thin clay films; neutral; clear wavy boundary.

B22t—26 to 29 inches; dark brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; friable; 5 percent pebbles; common thin clay films; neutral; clear wavy boundary.

B31—29 to 42 inches; dark brown (7.5YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; 1 percent pebbles; neutral; clear wavy boundary.

B32t—42 to 45 inches; dark brown (7.5YR 4/4) gravelly sandy loam; weak fine subangular blocky structure; very friable; 15 percent pebbles; few thin clay films; neutral; abrupt irregular boundary.

IIC—45 to 60 inches; pale brown (10YR 6/3) gravelly sand; single grain; loose; 30 percent pebbles; violent effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 45 to 60 inches. The content of pebbles ranges from 15 to 30 percent in the lower part of the solum and in the C horizon.

The Ap horizon has color value of 3 to 5 and chroma of 2 or 3. The A2 horizon has color value of 4 or 5 and chroma of 3 or 4. Reaction in the A horizon ranges from medium acid to neutral. Some pedons do not have an A2 horizon.

The B2t horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 3 to 6. It is sandy loam or sandy clay loam, or gravelly phases of these textures. Reaction in the B horizon ranges from medium acid to neutral. Some pedons do not have a B3 horizon. Some pedons have a sand or loamy sand B1 horizon.

The C horizon has color value of 5 or 6 and chroma of 3 to 6. It is sand or gravelly sand. It is mildly alkaline or moderately alkaline.

Oshtemo series

The Oshtemo series consists of deep, well drained soils that are moderately rapidly permeable in the upper part of the solum, rapidly permeable in the lower part of the solum, and very rapidly permeable in the substratum. These soils are on outwash plains, valley trains, and moraines. They formed in sandy and loamy glaciofluvial deposits. The slope ranges from 0 to 18 percent.

The Oshtemo soils are similar to Boyer and Hillsdale soils and are commonly adjacent to Boyer, Brady, Leoni, and Spinks soils on the landscape. The Boyer soils have a thinner and less acid solum. The Hillsdale soils do not have a substratum of sand and gravel. The Brady soils are somewhat poorly drained and are on slightly lower positions on the landscape than the Oshtemo soils. Leoni soils have more clay, and they have more pebbles and cobbles in the Bt horizon. The Spinks soils have more sand in the solum. The Boyer, Leoni, Hillsdale, Spinks, and Oshtemo soils are on similar positions on the landscape.

Typical pedon of Oshtemo sandy loam in an area of Boyer-Oshtemo sandy loams, 1 to 6 percent slopes,

1,060 feet south and 30 feet east of the NW corner of sec. 8, T. 3 S., R. 2 E., in Grass Lake Township:

Ap—0 to 10 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; very friable; 5 percent pebbles; slightly acid abrupt smooth boundary.

A2—10 to 17 inches; yellowish brown (10YR 5/4) sandy loam; moderate fine subangular blocky structure; friable, 5 percent pebbles; slightly acid; clear wavy boundary

B21t—17 to 23 inches; strong brown (7.5YR 5/6) gravelly sandy loam moderate fine subangular blocky structure; friable; 27 percent pebbles; slightly acid; clear wavy boundary.

B22t 23 to 28 inches, yellowish red (5YR 4/6) gravelly sandy clay loam; moderate medium subangular blocky structure; firm, clay bridging between sand grains, common thin clay films on faces of peds and pebbles; 23 percent pebbles, neutral; clear wavy boundary.

IIB3—28 to 50 inches; strong brown (7.5YR 5/6) sand, single grain; loose; and dark brown (7.5YR 4/4) loamy sand lamellae 1/8 to 1 inch in thickness, weak fine subangular blocky structure; very friable; 1 percent pebbles neutral; abrupt wavy boundary

IIC—50 to 60 inches; yellowish brown (10YR 5/4) gravelly sand, single grain; loose; 50 percent pebbles; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 40 to 60 inches. The solum is 1 to 30 percent pebbles and cobbles and is strongly acid to neutral.

The Ap horizon has color value of 3 to 5 and chroma of 2 or 3. It is dominantly sandy loam, but the range includes loamy sand. The A2 horizon has chroma of 3 to 6. It is sandy loam or loamy sand

The B2t horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 3 to 6. It is sandy loam, sandy clay loam, or gravelly phases of these textures.

The IIC horizon has color value of 4 or 5 and chroma of 2 to 4. It is mildly alkaline or moderately alkaline.

Owosso series

The Owosso series consists of deep, well drained soils that are moderately rapidly permeable in the upper part of the solum and moderately slowly permeable in the lower part of the solum and in the substratum. These soils are on till plains and moraines. They formed in loamy glaciofluvial deposits and in the underlying loamy glacial till. The slope ranges from 2 to 12 percent

The Owosso soils are similar to Riddles soils and are commonly adjacent to Capac, Marlette, and Riddles soils on the landscape. The Riddles, Capac, and Marlette soils have more clay in the upper part of the solum. The Capac soils are somewhat poorly drained and are on slightly lower positions on the landscape than the Owosso soils. The Marlette, Riddles, and Owosso soils are on similar positions on the landscape.

Typical pedon of Owosso sandy loam in an area of Marlette-Owosso complex, 6 to 12 percent slopes, 2,400 feet east and 1,100 feet south of the NW corner of sec 3, T. 1 S., R. 3 W., in Springport Township:

Ap—0 to 8 inches dark brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; very friable; 5 percent pebbles, slightly acid; abrupt smooth boundary.

B1—8 to 12 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure, very friable; 5 percent pebbles; slightly acid; clear smooth boundary.

B21t—12 to 26 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; many thin dark brown (7.5YR 4/4) clay films on faces of peds, 5 percent pebbles, slightly acid, abrupt wavy boundary

B22t—26 to 32 inches; dark brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; many thin dark brown (7.5YR 4/4) clay films on faces of peds, 5 percent pebbles; neutral; abrupt wavy boundary

IIB23t—32 to 43 inches; dark brown (10YR 4/3) clay loam; moderate medium subangular blocky structure; firm; continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; 5 percent pebbles; neutral, clear wavy boundary.

IIC—43 to 60 inches; yellowish brown (10YR 5/4) loam, massive; friable; 5 percent pebbles; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 24 to 50 inches. The IIB horizon is at a depth of 20 to 40 inches. The content of pebbles ranges from 2 to 10 percent throughout. The solum ranges from strongly acid to neutral.

The Ap horizon has color value of 3 to 5 and chroma of 2 or 3 It is sandy loam or fine sandy loam. Some pedons have an A2 horizon.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6 It is dominantly sandy loam or sandy clay loam, but the range includes fine sandy loam

The IIB2t horizon is similar in color to the B2t horizon. It is dominantly clay loam, but the range includes loam

The IIC horizon has color value of 4 to 6 and chroma of 3 or 4. It is dominantly loam, but the range includes clay loam. It is mildly alkaline or moderately alkaline.

Palms series

The Palms series consists of deep, very poorly drained soils that formed in decomposed herbaceous material and in the underlying loamy mineral deposits. These

soils are in bogs and other depressional areas on glacial drainageways, outwash plains, lake plains, till plains, and moraines. Permeability is moderately slow to moderately rapid in the organic material and moderate in the substratum. The slope is 0 to 2 percent.

The Palms soils are similar to Henrietta and Houghton soils and are commonly adjacent to Edwards, Henrietta, Houghton and Martisco soils on the landscape. The Henrietta soils have less than 16 inches of organic material over loamy material. The Houghton soils have more than 51 inches of organic material. The Edwards soils have 16 to 51 inches of organic material over marl. The Martisco soils have 8 to 16 inches of organic material over marl. The Henrietta, Houghton, Edwards, Martisco, and Palms soils are on similar positions on the landscape.

Typical pedon of Palms muck, 660 feet east and 50 feet north of the center of sec. 1, T. 4 S., R. 1 W., in Liberty Township.

Oa1—0 to 5 inches; black (N 2/0) broken face and rubbed sapric material; about 5 percent fiber unrubbed, less than 5 percent rubbed; weak fine subangular blocky structure parting to moderate medium granular; very friable; primarily herbaceous fibers; about 10 percent mineral material; neutral; abrupt smooth boundary.

Oa2—5 to 16 inches; black (5YR 2/1) broken face, black (N 2/0) rubbed sapric material, about 15 percent fiber unrubbed, less than 1 percent rubbed; reddish brown (5YR 4/4) and yellowish red (5YR 4/8) stains on faces of peds, moderate medium subangular blocky structure parting to moderate medium granular; friable; primarily herbaceous fibers; about 5 percent mineral material; neutral; abrupt smooth boundary.

Oa3—16 to 23 inches, black (N 2/0) broken face and rubbed sapric material; about 20 percent fiber unrubbed, less than 1 percent rubbed; massive; very friable primarily herbaceous fibers; about 5 percent mineral material, neutral; clear wavy boundary.

Oa4—23 to 30 inches, black (N 2/0) broken face and rubbed sapric material; about 30 percent fiber unrubbed, less than 5 percent rubbed, massive, very friable; primarily herbaceous fibers; about 5 percent mineral material; mildly alkaline; abrupt smooth boundary.

Oa5—30 to 32 inches; black (N 2/0) broken face and rubbed sapric material; about 10 percent fiber unrubbed, less than 1 percent rubbed, massive; friable; primarily herbaceous fibers; about 50 percent mineral material; mildly alkaline, clear smooth boundary.

IIC1g—32 to 46 inches; grayish brown (10YR 5/2) and brown (10YR 5/3) sandy loam; common fine prominent strong brown (7.5YR 5/6) mottles; massive, friable; about 15 percent pebbles; strong effervescence moderately alkaline; abrupt wavy boundary.

IIIC2g—46 to 60 inches; grayish brown (10YR 5/2) loamy sand; common medium faint brown (10YR 5/3) and many medium prominent brownish yellow (10YR 6/6) and strong brown (7.5YR 5/6) mottles, massive; very friable, about 10 percent pebbles; strong effervescence; moderately alkaline.

The organic material is 16 to 50 inches deep. It is primarily herbaceous, but in many pedons it has woody fragments throughout. The organic material has hue of 10YR, 7.5YR, or 5YR, value of 2 or 3, and chroma of 0 to 3. Reaction ranges from strongly acid to mildly alkaline.

The surface tier is typically sapric material, but the range includes hemic material.

The subsurface tier and the bottom tier are dominantly sapric material. Some pedons have less than 10 inches of hemic material in these tiers. Some pedons have less than 2 inches of limnic material above the IICg horizon.

The IICg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7, and chroma of 1 or 2. It is sandy loam, fine sandy loam, loam, silt loam, or clay loam. Reaction ranges from slightly acid to moderately alkaline. Some pedons do not have a IIICg horizon.

Riddles series

The Riddles series consists of deep, well drained, moderately permeable soils on till plains and moraines. These soils formed in loamy glacial till. The slope ranges from 0 to 30 percent.

The Riddles soils are similar to Owosso soils and are commonly adjacent to Barry, Hillsdale, and Leoni soils on the landscape. The Owosso soils have less clay in the upper part of the solum than the Riddles soils. The Barry soils are poorly drained and are on lower positions on the landscape than the Riddles soils. The Hillsdale soils have less clay in the solum. The Leoni soils have more pebbles and cobbles in the solum. The Hillsdale, Leoni, and Riddles soils are on similar positions on the landscape.

Typical pedon of Riddles sandy loam, 2 to 6 percent slopes, 2,440 feet north and 360 feet east of the SW corner of sec. 31, T. 3 S., R. 1 W., in Summit Township:

Ap—0 to 9 inches; dark brown (10YR 4/3) sandy loam; moderate fine subangular blocky structure; friable, 5 percent pebbles; medium acid, abrupt smooth boundary.

A2—9 to 13 inches; yellowish brown (10YR 5/4) sandy loam; moderate medium subangular blocky structure; friable; dark brown (10YR 4/3) worm casts; 5 percent pebbles; medium acid; clear wavy boundary.

B21t—13 to 19 inches, yellowish brown (10YR 5/6) sandy clay loam; moderate medium subangular blocky structure, firm; common thin dark brown (7.5YR 4/4) clay films on faces of peds, few fine

prominent dark reddish brown (5YR 3/2) stains on faces of peds; 5 percent pebbles; medium acid; clear wavy boundary

B22t—19 to 31 inches; yellowish brown (10YR 5/6) clay loam; strong medium subangular blocky structure; firm; continuous moderately thick dark brown (7.5YR 4/4) clay films on faces of peds; common fine distinct dark reddish brown (5YR 3/2) stains on faces of peds; 5 percent pebbles; medium acid; abrupt wavy boundary.

B23t—31 to 44 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium subangular blocky structure; friable; common thin dark brown (7.5YR 4/4) clay films on faces of peds; 5 percent pebbles; medium acid; gradual wavy boundary.

B3—44 to 54 inches; yellowish brown (10YR 5/4) sandy loam; weak fine subangular blocky structure; friable; 10 percent pebbles; slightly acid; clear wavy boundary.

C—54 to 60 inches; yellowish brown (10YR 5/4) sandy loam; massive; friable; 3 percent pebbles; strong effervescence; moderately alkaline

The thickness of the solum and the depth to free carbonates range from 40 to 70 inches. The content of pebbles is 0 to 10 percent throughout. The solum ranges from strongly acid to neutral

The Ap horizon has color value of 4 or 5 and chroma of 2 or 3. It ranges in thickness from 6 to 10 inches. It is dominantly sandy loam, but the range includes loam. The A2 horizon has color value of 5 or 6 and chroma of 3 or 4. It is dominantly sandy loam, but the range includes loam. Some pedons do not have an A2 horizon.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is dominantly sandy clay loam or clay loam, but in some pedons it has layers of sandy loam and loam. Some pedons do not have a B3 horizon

The C horizon has color value of 5 or 6 and chroma of 3 or 4. It is dominantly sandy loam, but the range includes loam and layers of loamy sand. It is mildly alkaline or moderately alkaline

Saylesville series

The Saylesville series consists of deep, well drained, moderately slowly permeable soils on lake plains, terraces, and depressional areas on moraines. These soils formed in silty and clayey glaciolacustrine sediments. The slope ranges from 2 to 8 percent

The Saylesville soils are similar to Del Rey soils and are commonly adjacent to Arkport, Del Rey, and Okee soils on the landscape. The Del Rey soils are somewhat poorly drained and are on slightly lower positions on the landscape than the Saylesville soils. The Arkport and Okee soils have more sand than the Saylesville soils and are on positions on the landscape similar to those of the Saylesville soils

Typical pedon of Saylesville silt loam, 2 to 8 percent slopes, 1 960 feet east and 780 feet north of the SW. corner of sec. 27, T. 1 S., R. 2 E., in Waterloo Township:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak fine subangular blocky structure; friable; 1 percent pebbles; slightly acid; abrupt smooth boundary.

A2—8 to 10 inches, brown (10YR 5/3) loam; weak thin platy and moderate medium subangular blocky structure, friable, 1 percent pebbles; slightly acid; abrupt wavy boundary.

B21t—10 to 15 inches yellowish brown (10YR 5/4) silty clay loam, moderate fine and medium subangular blocky structure, firm; many thin dark yellowish brown (10YR 4/4) clay films on faces of peds; few black (10YR 2/1) stains on faces of peds; 1 percent pebbles; slightly acid; clear wavy boundary

B22t—15 to 22 inches. dark brown (10YR 4/3) silty clay loam; moderate medium angular blocky structure parting to strong fine angular blocky, firm; many thin clay films on faces of peds; few black (10YR 2/1) stains on faces of peds; 1 percent pebbles; neutral; abrupt smooth boundary.

C—22 to 60 inches; brown (10YR 5/3) silty clay loam; weak fine subangular blocky structure; firm, few light gray (10YR 7/2) lime coatings on faces of peds; strong effervescence; moderately alkaline

The thickness of the solum and the depth to free carbonates range from 20 to 40 inches. The content of pebbles ranges from 0 to 5 percent throughout. The solum ranges from medium acid to mildly alkaline.

The Ap horizon has color value of 4 or 5. It is dominantly silt loam, but the range includes loam. The A2 horizon has color value of 4 to 6 and chroma of 2 or 3. It is loam or silt loam

The B2t horizon has color value of 4 or 5 and chroma of 3 or 4. It is silty clay loam or silty clay.

The C horizon has color value of 4 or 5 and chroma of 3 or 4. It is dominantly silty clay loam. In some pedons it has thin layers of silt, silty clay, and very fine sandy loam.

Sebewa series

The Sebewa series consists of deep, poorly drained soils that are moderately permeable in the solum and rapidly permeable in the substratum. These soils are on outwash plains valley trains, and terraces. They formed in loamy glaciofluvial deposits and in the underlying sandy glacial drift. The slope is 0 to 2 percent

The Sebewa soils are similar to Colwood soils and are commonly adjacent to Brady, Colwood, and Gilford soils on the landscape. The Colwood soils have more silt in the pedon. The Brady soils are somewhat poorly drained and are on slightly higher positions on the landscape than the Sebewa soils. The Gilford soils have less clay in

the B horizon. The Colwood, Gilford, and Sebewa soils are on similar positions on the landscape.

Typical pedon of Sebewa loam, 1 860 feet east and 255 feet south of the NW. corner of sec. 30, T. 2 S., R. 1 W., in Blackman Township:

Ap—0 to 10 inches; black (10YR 2/1) loam, gray (10YR 5/1) dry; moderate fine subangular blocky structure friable; slightly acid; abrupt smooth boundary.

A12g—10 to 15 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate fine subangular blocky structure; friable, neutral; clear wavy boundary

B21tg—15 to 26 inches, dark gray (10YR 4/1) clay loam; common fine prominent strong brown (7.5YR 5/6) mottles, coarse medium subangular blocky structure; firm; continuous thick very dark gray (10YR 3/1) clay films on faces of peds; 2 percent pebbles; neutral; clear wavy boundary.

B22tg—26 to 33 inches; gray (10YR 5/1) clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; continuous thick very dark gray (10YR 3/1) clay films on faces of peds; 2 percent pebbles, neutral; clear wavy boundary.

B3g—33 to 35 inches; gray (10YR 5/1) sandy loam; fine medium prominent yellowish brown (10YR 5/6) mottles; fine medium subangular blocky structure; friable; 2 percent pebbles; neutral; clear wavy boundary

IIC1g—35 to 50 inches, gray (10YR 6/1) sand, single grain; loose; slight effervescence 10 percent pebbles; mildly alkaline; abrupt wavy boundary.

IIC2g—50 to 60 inches, light brownish gray (10YR 6/2) sand; single grain, loose; 10 percent pebbles; strong effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. Free carbonates are at a depth of 18 to 36 inches. The mollic epipedon is 10 to 15 inches thick. The content of pebbles ranges from 0 to 15 percent in the upper part of the solum, from 5 to 25 percent in the lower part of the solum, and from 5 to 60 percent in the IIC horizon. The solum ranges from slightly acid to mildly alkaline.

The Ap horizon has color value of 2 or 3 and chroma of 1 or 2 It ranges in thickness from 8 to 11 inches. It is dominantly loam, but the range includes sandy loam. The A12g horizon has color value of 2 or 3 and chroma of 1 or 2. It is dominantly loam, but the range includes sandy loam. Some pedons do not have an A12g horizon.

The B2tg horizon has hue of 10YR, 2.5Y, or 5Y value of 4 to 6, and chroma of 1 or 2. It is dominantly clay loam, but the range includes sandy clay loam, gravelly clay loam and gravelly loam. Some pedons do not have a B3g horizon.

The IICg horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 1 or 2. It is sand or gravelly sand. It is mildly alkaline or moderately alkaline.

Spinks series

The Spinks series consists of deep well drained, moderately rapidly and rapidly permeable soils on moraines, eskers, outwash plains, and till plains. These soils formed in sandy glaciofluvial deposits. The slope ranges from 0 to 25 percent.

The Spinks soils are similar to Arkport soils and are commonly adjacent to Boyer, Ormas, and Oshtemo soils on the landscape. The Arkport soils have a B horizon that consists of lamellae The Boyer, Ormas, and Oshtemo soils have finer textured, continuous Bt horizons that typically contain more gravel. The Arkport, Boyer, Ormas, Oshtemo, and Spinks soils are on similar positions on the landscape.

Typical pedon of Spinks sand, 0 to 6 percent slopes, 100 feet south and 1,910 feet east of the center of sec. 36, T 3 S., R 1 W., in Summit Township

Ap—0 to 6 inches dark brown (10YR 4/3) sand; moderate fine granular structure; very friable; medium acid; abrupt smooth boundary

A21—6 to 18 inches; brownish yellow (10YR 6/6) sand; single grain; loose; medium acid; gradual wavy boundary.

A22—18 to 29 inches, light yellowish brown (10YR 6/4) sand; single grain; loose; medium acid; abrupt wavy boundary

A&B—29 to 60 inches; light yellowish brown (10YR 6/4) sand (A2), single grain; loose; bands of dark brown (7 5YR 4/4) fine sand (B2t); weak medium subangular blocky structure, friable, discontinuous bands, 1 inch to 5 inches thick, that have a cumulative thickness of more than 6 inches; slightly acid

The thickness of the solum and the depth to free carbonates range from 40 to more than 60 inches. The content of pebbles ranges from 0 to 15 percent throughout. The solum ranges from medium acid to mildly alkaline

The Ap horizon has color value of 3 or 4 and chroma of 2 or 3. It is dominantly sand, but the range includes fine sand and loamy sand. The A2 horizon has color value of 5 or 6 and chroma of 4 to 6. It is sand, fine sand, or loamy sand.

In the A&B horizon the A part is similar in color and texture to the A2 horizon. The B part has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6 The bands of the B part are dominantly sand, but the range includes loamy sand and loamy fine sand. These bands are 1/8 inch to 5 inches thick, are often discontinuous, and have cumulative thickness of more than 6 inches The first band of the B horizon is at a depth of 15 to about 36 inches.

Teasdale series

The Teasdale series consists of deep, somewhat poorly drained, moderately permeable soils on till plains and moraines. These soils formed in loamy glacial till. The slope ranges from 0 to 3 percent.

The Teasdale soils are commonly adjacent to Barry, Hillsdale, and Riddles soils on the landscape. The Barry soils are poorly drained and are on lower positions on the landscape than the Teasdale soils. The Hillsdale and Riddles soils are well drained and are on higher positions on the landscape than the Teasdale soils.

Typical pedon of Teasdale fine sandy loam, 0 to 3 percent slopes, 1,400 feet west and 600 feet south of the NE. corner of sec. 3, T. 3 S., R. 2 W., in Spring Arbor Township:

Ap—0 to 9 inches; dark brown (10YR 3/3) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; 5 percent cobbles, 2 percent pebbles; medium acid; abrupt smooth boundary.

A2—9 to 13 inches; yellowish brown (10YR 5/4) fine sandy loam; few fine faint dark yellowish brown (10YR 4/4) and common medium faint brown (10YR 5/3) and pale brown (10YR 6/3) mottles; moderate thin platy structure parting to weak medium granular; friable; 2 percent cobbles, 2 percent pebbles; strongly acid; gradual wavy boundary.

B&A—13 to 24 inches; brown (10YR 5/3) fine sandy loam (A2), gray (10YR 7/2) dry; weak medium granular structure; friable; interfingering into dark yellowish brown (10YR 4/4) fine sandy loam (B), common medium faint grayish brown (10YR 5/2) and common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; 10 percent cobbles, 7 percent pebbles; strongly acid; clear wavy boundary.

B21t—24 to 43 inches; dark brown (7.5YR 4/4) fine sandy loam, many medium distinct strong brown (7.5YR 5/6) and common medium distinct grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) mottles; moderate coarse subangular blocky structure; friable; thin dark brown (10YR 4/3) coatings on faces of peds in the upper 10 inches of the horizon; thin discontinuous dark grayish brown (10YR 4/2) clay films; 5 percent cobbles, 5 percent pebbles; strongly acid; gradual wavy boundary.

B22t—43 to 55 inches; dark yellowish brown (10YR 4/4) fine sandy loam, common medium distinct yellowish brown (10YR 5/6) and few coarse distinct light brownish gray (10YR 6/2) mottles; moderate coarse subangular blocky structure; friable; thick continuous very dark grayish brown (10YR 3/2) clay films, 5 percent cobbles, 5 percent pebbles; slightly acid; gradual wavy boundary.

C—55 to 65 inches, yellowish brown (10YR 5/4) fine sandy loam; few fine distinct yellowish brown (10YR 5/6) mottles, massive; friable; 10 percent cobbles 5 percent pebbles slight effervescence; moderately alkaline.

The solum is 40 to 60 inches thick. Free carbonates are at a depth of 40 to more than 60 inches. The content of pebbles and cobbles ranges from 2 to 20 percent throughout.

The Ap horizon has color value of 3 or 4 and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes loam and sandy loam. The A2 horizon has color value of 5 or 6 and chroma of 2 to 5. It is similar in texture to the Ap horizon. The A horizon ranges from strongly acid to slightly acid.

In the B&A horizon, coatings of A2 material, 2 to 5 millimeters thick, are on the vertical faces of peds. The B part has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is fine sandy loam, loam, sandy loam, or the gravelly or cobbly phases.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is fine sandy loam, sandy loam, loam, clay loam, or the gravelly or cobbly phases. Reaction ranges from strongly acid to neutral.

The C horizon is fine sandy loam, sandy loam, or the gravelly and cobbly phases. Reaction ranges from neutral to moderately alkaline.

Wauseon series

The Wauseon series consists of deep, very poorly drained soils that are moderately rapidly permeable and rapidly permeable in the solum and very slowly permeable in the substratum. These soils are on lake plains and terraces and in depressional areas on moraines. They formed in sandy or loamy glaciofluvial deposits and in the underlying silty and clayey lacustrine sediments. The slope ranges from 0 to 3 percent.

These soils have more pebbles and cobbles in the solum than allowed for the Wauseon series, but this difference does not alter the use and behavior of the soils.

The Wauseon soils are similar to Ypsi soils and are commonly adjacent to Colwood, Gilford, and Ypsi soils on the landscape. The Colwood soils have more clay in the lower part of the solum. The Gilford soils, unlike the Wauseon soils, do not have fine textured underlying material within a depth of 40 inches. The Colwood, Gilford, and Wauseon soils are on similar positions on the landscape. The Ypsi soils do not have a mollic Ap horizon and are on higher positions on the landscape than the Wauseon soils.

Typical pedon of Wauseon loam in an area of Ypsi-Wauseon complex, 0 to 3 percent slopes, 135 feet west and 180 feet south of the NE. corner of sec. 22, T. 2 S., R. 1 W., in Blackman Township:

A11—0 to 10 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate medium granular

structure; very friable mildly alkaline; clear smooth boundary.

A12—10 to 13 inches; black (10YR 2/1) loam; dark gray (10YR 4/1) dry; common medium distinct grayish brown (10YR 5/2) and few fine prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; very friable; mildly alkaline; clear wavy boundary.

B21g—13 to 26 inches; grayish brown (10YR 5/2) sandy loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure friable; 10 percent pebbles, mildly alkaline; gradual smooth boundary.

B22g—26 to 36 inches; gray (10YR 5/1) gravelly sandy loam; common medium distinct yellowish brown (10YR 5/4) and many medium prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; very friable; 25 percent pebbles; mildly alkaline; abrupt smooth boundary.

IICg—36 to 60 inches; stratified gray (10YR 5/1) and brown (10YR 5/3) silty clay and silty clay loam; few fine faint light gray (10YR 6/1) and common fine prominent yellowish brown (10YR 5/8) mottles; massive; very firm, violent effervescence; moderately alkaline

The thickness of the solum and depth to free carbonates range from 24 to 36 inches. The mollic epipedon is from 10 to 15 inches thick. The solum is 1 to 25 percent pebbles and ranges from slightly acid to mildly alkaline

The A1 horizon has color value of 2 or 3 and chroma of 1 or 2. It is dominantly loam, but the range includes sandy loam and fine sandy loam.

The B2g horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2 It is sandy loam, loamy fine sand, or gravelly sandy loam.

The IIC horizon has color value of 4 to 6 and chroma of 1 or 4. It is silty clay loam, silty clay, or clay. It is mildly alkaline or moderately alkaline

Whalan series

The Whalan series consists of moderately deep, well drained soils that are moderately permeable in the upper part of the solum and slowly permeable in the lower part. These soils are on till plains and outwash plains. They formed in loamy glacial drift and a thin layer of silty or clayey residuum weathered from limestone bedrock. The slope ranges from 1 to 6 percent.

The Whalan soils are commonly adjacent to Brady, Eleva, Hillsdale, and Riddles soils on the landscape The Brady soils do not have limestone between depths of 20 and 40 inches, are somewhat poorly drained, and are on slightly lower positions on the landscape than the Whalan soils. The Eleva soils are underlain by sandstone bedrock. Hillsdale and Riddles soils do not have limestone between depths of 20 and 40 inches. The Eleva, Hillsdale, Riddles, and Whalan soils are on similar positions on the landscape.

Typical pedon of Whalan loam, 1 to 6 percent slopes, 1,000 feet north and 200 feet east of the center of sec 30, T. 2 S., R. 2 W., in Sandstone Township:

Ap—0 to 9 inches; dark brown (10YR 4/3) loam, moderate fine subangular blocky structure; friable 2 percent pebbles; neutral; abrupt smooth boundary.

B1—9 to 11 inches dark yellowish brown (10YR 4/4) loam; moderate fine subangular blocky structure; friable, 2 percent pebbles; neutral; clear wavy boundary.

B21t—11 to 21 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; many clay films on faces of peds; 2 percent pebbles; neutral, clear wavy boundary.

IIB22t—21 to 26 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure firm; many clay films on faces of peds; 2 percent pebbles; neutral; clear wavy boundary.

IIB3—26 to 30 inches; strong brown (7.5YR 5/6) silty clay loam, weak medium subangular blocky structure; friable; 2 percent pebbles, neutral, abrupt wavy boundary.

R—30 to 60 inches; light yellowish brown (10YR 6/4) limestone bedrock; strong effervescence; mildly alkaline

The thickness of the solum and depth to limestone bedrock range from 20 to 40 inches The IIB horizon is at a depth of 15 to 35 inches The content of pebbles ranges from 2 to 30 percent in the solum

The Ap horizon has color value of 3 or 4 and chroma of 2 or 3. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 5. It is clay loam or loam Reaction ranges from medium acid to slightly acid.

The IIB2t horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 3 to 6. It is clay loam, silty clay loam, silty clay, or clay Reaction ranges from medium acid to mildly alkaline.

Ypsi series

The Ypsi series consists of deep, somewhat poorly drained soils that are moderately rapidly permeable in the solum and slowly permeable in the substratum. These soils are on lake plains and terraces and in depressional areas on moraines. They formed in sandy or loamy glaciofluvial deposits over silty and clayey lacustrine sediments The slope ranges from 0 to 3 percent.

The Ypsi soils are similar to Wauseon soils and are commonly adjacent to Colwood, Gilford, and Wauseon soils on the landscape The Colwood soils have more clay in the lower part of the solum than the Ypsi soils. The Gilford soils have more sand in the substratum The Wauseon soils have a mollic A horizon The Colwood,

Gilford, and Wauseon soils are very poorly drained or poorly drained and are on lower positions on the landscape than the Ypsi soils.

Typical pedon of Ypsi sandy loam in an area of Ypsi-Wauseon complex, 0 to 3 percent slopes, 225 feet west and 90 feet south of the NE. corner of sec. 22, T. 2 S., R. 1 W., in Blackman Township

A1—0 to 8 inches, very dark gray (10YR 3/1) sandy loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to moderate medium granular; friable, mildly alkaline; clear wavy boundary.

B21t—8 to 18 inches; dark grayish brown (10YR 4/2) sandy loam, few faint prominent yellowish brown (10YR 5/6) mottles, moderate medium subangular blocky structure; friable, common thin brown (10YR 5/3) clay films on faces of peds, very dark gray (10YR 3/1) wormcasts and channels; mildly alkaline; clear wavy boundary.

B22t—18 to 25 inches; yellowish brown (10YR 5/6) sandy loam; many medium faint strong brown (7.5YR 5/6) and many medium prominent grayish brown (10YR 5/2) mottles, moderate medium subangular blocky structure; friable, common moderately thick grayish brown (10YR 5/2) clay films on faces of peds; very dark gray (10YR 3/1) wormcasts and channels; 15 percent pebbles; mildly alkaline; clear wavy boundary.

B3—25 to 29 inches; yellowish brown (10YR 5/8) gravelly sandy loam; few fine and medium prominent grayish brown (10YR 5/8) mottles weak medium subangular blocky structure; very friable, very dark gray (10YR 3/1) wormcasts and channels, 20 percent pebbles, mildly alkaline; abrupt smooth boundary.

IIC—29 to 60 inches; brown (10YR 5/3) stratified silty clay and silty clay loam; many fine prominent strong brown (7.5YR 5/6) and many medium distinct gray (10YR 5/1) mottles, massive; very firm; light gray (10YR 7/1) calcium carbonate accumulations; strong effervescence; moderately alkaline.

The thickness of the solum and depth to free carbonates range from 24 to 40 inches. The solum is 1 to 20 percent pebbles and ranges from slightly acid to mildly alkaline.

The A1 horizon has color value of 2 or 3 and chroma of 1 to 3. It ranges in thickness from 7 to 9 inches. It is dominantly sandy loam, but the range includes loamy sand.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 6. It is sandy loam or loamy sand.

The IIC horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 to 7, and chroma of 1 to 3. It is silty clay loam, silty clay, or clay. It is mildly alkaline or moderately alkaline.

formation of the soils

The paragraphs that follow describe the factors of soil formation, relate them to the formation of soils in the survey area, and explain the processes of soil formation.

factors of soil formation

Soil is formed through the interaction of five major factors: the physical, chemical, and mineral composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the processes of soil formation have acted on the parent material (*3*).

Climate and plant and animal life are the active forces in soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and plant and animal life are modified by relief. The nature of the parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into soil. It may be long or short, but some time is required for differentiation of soil horizons. Generally, a long time is required for the formation of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soils that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

parent material

Parent material is the unconsolidated mass from which a soil forms. Most of the parent materials of the soils in Jackson County were deposited by glaciers or by melt water from the glaciers, which covered the county about 10,000 to 12,000 years ago. Some of these materials have been reworked and redeposited by subsequent action of water and wind. Parent material determines the chemical and mineralogical composition of the soil. Although the parent materials are of a common glacial origin, their properties vary greatly, sometimes within a small area, depending on how the materials were deposited. The dominant parent materials in Jackson County were deposited as glacial till, outwash deposits, lacustrine deposits, alluvium, and organic material.

Glacial till is material that was deposited directly by glaciers with a minimum of water action. It is a mixture of particles of different sizes. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. The glacial till in Jackson County is calcareous loam or sandy loam. The Marlette soils are an example of soils that formed in this glacial till. They typically have a moderately fine texture and a well developed subsoil.

Outwash material is deposited by running water from melting glaciers. The size of the particles varies according to the speed of the stream that carried them. As the water slows down, the coarser particles are deposited. Only the finer particles, such as very fine sand, silt, and clay, can be carried by slowly moving water. Outwash deposits generally consist of layers of particles of similar size, such as sandy loam, sand, gravel, and other coarse particles. The Boyer soils, for example, formed in deposits of outwash material.

Lacustrine material is deposited from still, or ponded, glacial melt water. Because the coarser fragments drop out of the moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remain to settle out in still water. In Jackson County the soils that formed in lacustrine deposits are typically medium textured, moderately fine textured, and fine textured. The Lenawee soils, for example, formed in lacustrine material.

Alluvium is material recently deposited by the floodwaters of streams. This material varies in texture, depending on the speed of the water from which it was deposited. The Cohoctah soils are an example of alluvial soils.

Organic material is made up of deposits of plant remains. After the glaciers withdrew from the survey area, water was left standing in depressions in the outwash plains, flood plains, moraines, and till plains. Because of the wetness the grasses, sedges, and water-tolerant trees that grew around the edge of these depressions did not decompose quickly after they died. Eventually the plant residue filled the depressions and decomposed to form muck. Houghton soils, for example, formed in organic material.

The parent materials of some of the soils in Jackson County were formed in place through the disintegration and decomposition of sedimentary rocks. The unconsolidated mass of weathered bedrock is called residuum. Whalan soils, for example, formed in loamy

glacial drift and a thin layer of silty or clayey residuum of limestone bedrock.

plant and animal life

Green plants have been the principal organisms influencing soil formation in Jackson County. Bacteria, fungi, earthworms, and the activities of man have also been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kinds of plants that grew on the soil. The remains of these plants accumulate on the surface, decay, and eventually become organic matter. Roots of the plants provide channels for downward movement of water through the soil and also add organic matter as they decay. Bacteria in the soil help to break down the organic matter so that it can be used by growing plants.

The vegetation in Jackson County was mainly deciduous forest. Differences in natural soil drainage and minor changes in parent material affected the composition of the forest species.

In general, the well drained upland soils, such as the Boyer, Marlette, and Oshtemo soils, were mainly covered by sugar maple, oak, and hickory trees. The poorly drained and very poorly drained soils were covered mainly by soft maple, elm, and ash. The Colwood and Gilford soils formed under wet conditions, and they contain a considerable amount of organic matter.

climate

Climate determines the kind of plant and animal life on and in the soil. It also determines the amount of water available for the weathering of minerals and for the transporting of soil material. Through its influence on soil temperature, climate determines the rate of chemical reaction in the soil.

The climate in Jackson County is cool and humid, presumably similar to that in which the soils formed. The climate is uniform throughout the county. Its effect is modified locally according to the proximity to large lakes. Differences in climate account for only minor differences among the soils in Jackson County.

relief

Relief, or topography, affects the natural drainage of soils, the rate of erosion, the kind of plant cover, and the soil temperature. In Jackson County the slopes range from 0 to 40 percent. Runoff is most rapid on the steeper slopes. In low areas water is temporarily ponded.

The soils in Jackson County range from somewhat excessively drained and well drained, on the ridgetops, to poorly drained and very poorly drained, in the depressions.

Through its effect on the aeration of the soil, drainage partly determines the color of the soil. Water and air move freely through soils that are well drained and slowly through soils that are very poorly drained. In soils that are well aerated, the iron and aluminum compounds, which give most of the soils their color, are brightly colored and oxidized. In poorly aerated soils the color is dull gray and mottled. The Saylesville soils are well drained, well aerated soils. The Lenawee soils are poorly aerated, poorly drained soils. The Saylesville and Lenawee soils formed in similar parent material.

time

In general, a long time is required for the development of distinct horizons from parent material. The differences in the length of time that parent material has been in place commonly are reflected in the degree of development of the soil profile. Some soils develop rapidly, others slowly.

The soils in Jackson County range from young to mature. The glacial deposits in which many of the soils in Jackson County formed have been exposed to soil-forming factors long enough that distinct horizons have developed. The soils that formed in recent alluvial sediments, however, have not been in place long enough for distinct horizons to develop.

The Cohoctah soils are an example of young soils that formed in alluvial material. The Riddles soils are an example of soils that are old enough that distinct horizons have formed and lime (calcium carbonate) has leached from the solum.

processes of soil formation

The processes responsible for the development of the soil horizons from the unconsolidated parent material are referred to as soil genesis. The physical, chemical, and biological properties of the horizons are referred to as soil morphology.

Several processes were involved in the development of horizons in the soils of Jackson County: (1) the accumulation of organic matter, (2) the leaching to lime (calcium carbonate) and other bases, (3) the reduction and transfer of iron, and (4) the formation and translocation of silicate clay minerals. In most of the soils in Jackson County more than one of these processes has been active in the development of horizons.

As organic matter accumulates at the surface of a soil, an A1 horizon is formed. If the soil is plowed, the A1 horizon is mixed into the plow layer, or Ap horizon. In the soils in Jackson County, the surface layer ranges from high to low in content of organic matter. The Barry soils, for example, have a high content of organic matter in the surface layer, and the Spinks soils a low content.

The leaching of carbonates and other bases has occurred in most of the soils. The leaching of bases in soils generally precedes the translocation of silicate clay minerals. Many of the soils in Jackson County have been moderately to strongly leached. For example, Riddles

soils are leached of carbonates to a depth of 54 inches, whereas, Marlette soils are leached to a depth of only 32 inches. This difference in the depth of leaching is a result of time and parent material as soil-forming factors.

The reduction and transfer of iron, a process called gleying, is evident in the somewhat poorly drained, poorly drained, and very poorly drained soils. The gray subsoil indicates the reduction and loss of iron. Lenawee soils, for example, are strongly gleyed.

The translocation of clay minerals has contributed to horizon development. The eluviated, or leached, A2 horizon typically has a platy structure, is lower in content of clay, and typically is lighter in color than the illuviated B horizon. The B horizon typically has an accumulation of clay, or clay films, in pores and on the faces of peds. These soils were probably leached of carbonates and soluable salts to a considerable extent before the translocation of silicate clays. The leaching of bases and the translocation of silicate clays are among the more important processes in horizon differentiation in soils. The Marlette soils are an example of soils that have translocated silicate clays in the form of clay films accumulated in the B horizon.

references

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10 2 vol. illus.

(2) American Society for Testing and Materials 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487 69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp, illus.

(3) Jenny, Hans. 1941. Factors of soil formation McGraw-Hill Book Company, Inc., 281 pp., illus.

(4) Michigan Crop Reporting Service. 1977. Michigan agricultural statistics. Mich. Dep. Agric., 64 pp., illus.

(5) Michigan State University. 1976. Fertilizer recommendations for vegetables and field crops in Michigan. Ext. Bull. E 550, 20 pp.

(6) Mokma, D. L., E. P. Whiteside, and I. F. Schneider. 1978. Soil management units and land use planning. Mich. State Univ. Ext. Bull. E 1262, 12 pp.

(7) United States Department of Agriculture. 1926 Soil survey of Jackson County, Michigan. Bur. Chem. and Soils in coop. with Mich. Agric. Exp. Stn. Ser 1926, No. 17, 30 pp

(8) United States Department of Agriculture. 1951 Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp 173-188 issued May 1962]

(9) United States Department of Agriculture. 1961. Land capability classification. U S. Dep. Agric. Handb. 210, 21 pp.

(10) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb 436, 754 pp., illus.

(11) United States Department of Commerce. 1976. 1974 Census of Agriculture. Preliminary report, Jackson County, Mich., 4 pp.

glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Congeliturbate. Soil material disturbed by frost action.

Conservation tillage. A tillage system that does not invert the soil and that leaves all or part of the crop residue on the surface throughout the year.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow, very porous, or steep, or a combination of these.

Somewhat excessively drained.—Water is removed from the soil rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.

Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.

Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Poorly drained.—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these, (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-

forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1948-77 at Jackson, Michigan]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Snowfall
	°F	°F	°F	°F	°F		In	In	In		In
January----	29.5	15.0	22.2	57	12	0	1.69	0.9	2.4	4	8.6
February--	32.8	17.0	24.9	57	-11	0	1.73	0.8	2.5	5	7.4
March------	42.1	25.1	33.6	74	0	13	2.33	1.3	3.3	6	7.1
April------	57.2	36.4	46.8	82	17	92	3.04	2.0	4.0	7	1.8
May--------	69.0	46.4	57.7	88	28	275	2.91	1.7	4.0	6	**
June-------	78.8	56.6	67.7	95	38	539	3.53	2.2	4.7	7	0
July-------	82.8	60.6	71.7	97	46	682	3.18	2.0	4.3	6	0
August-----	81.1	58.8	69.9	95	42	626	2.73	1.4	3.9	5	0
September--	73.1	51.4	62.3	93	31	381	2.32	1.3	3.3	6	**
October----	62.2	41.3	51.8	85	21	151	2.12	.8	3.2	5	**
November---	46.1	31.1	38.6	72	6	24	2.22	1.5	2.9	6	4.1
December---	33.8	20.3	27.1	61	-7	0	1.90	.9	2.7	5	8.5
Year - -	57.4	38.3	47.9	98	-14	2,783	29.70	25.7	33.5	68	37.4

* A growing degree day is an index of the amount of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

** Trace

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1930-74 at Jackson, Michigan]

Probability	Temperature: 24° F or lower	Temperature: 28° F or lower	Temperature: 32° F or lower
Last freezing temperature in spring			
1 year in 10 later than--	April 24	May 5	May 21
2 years in 10 later than--	April 19	May 1	May 17
5 years in 10 later than	April 9	April 23	May 8
First freezing temperature in fall			
1 year in 10 earlier than--	October 18	October 5	September 22
2 years in 10 earlier than	October 24	October 10	September 26
5 years in 10 earlier than--	November 5	October 21	October 6

TABLE 3.--GROWING SEASON

[Recorded in the period 1930-74 at Jackson, Michigan]

Probability	Daily minimum temperature during growing season: Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	184	16[illegible]	132
8 years in 10	194	168	138
5 years in 10	209	181	150
2 years in 10	226	194	162
1 year in 10	235	201	169

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
11B	Boyer-Oshtemo sandy loams, 1 to 6 percent slopes	14,040	2.9
11C	Boyer-Oshtemo sandy loams, 6 to 12 percent slopes	8,410	1.8
11D	Boyer-Oshtemo sandy loams, 12 to 18 percent slopes	2,940	0.6
11E	Boyer-Leoni complex, 18 to 40 percent slopes	825	0.2
13B	Ormas-Spinks complex, 0 to 6 percent slopes	27,615	6.0
13C	Ormas-Spinks complex, 6 to 12 percent slopes	14,505	3.2
13D	Ormas-Spinks complex, 12 to 25 percent slopes	4,125	0.9
14B	Spinks sand, 0 to 6 percent slopes	11,770	2.6
14C	Spinks sand, 6 to 12 percent slopes	6,010	1.3
14D	Spinks sand, 12 to 25 percent slopes	2,765	0.6
15A	Teasdale fine sandy loam, 0 to 3 percent slopes	14,510	3.2
16A	Brady sandy loam, 0 to 3 percent slopes	11,510	2.5
17	Barry loam	8,485	1.8
18	Gilford-Colwood complex	20,670	4.5
20	Houghton muck	37,530	8.2
22	Cohoctah fine sandy loam	3,445	0.8
29A	Kibbie fine sandy loam, 0 to 3 percent slopes	1,745	0.4
30	Edwards muck	6,390	1.4
35B	Arkport-Okee loamy fine sands, 2 to 6 percent slopes	12,200	2.7
35C	Arkport Okee loamy fine sands, 6 to 12 percent slopes	8,490	1.9
35D	Arkport Okee loamy fine sands, 12 to 25 percent slopes	2,235	0.5
37	Palms muck	22,990	5.0
39A	Ypsi-Wauseon complex, 0 to 3 percent slopes	1,100	0.2
40	Lenawee silt loam	1,905	0.4
42A	Riddles sandy loam, 0 to 2 percent slopes	3,460	0.8
42B	Riddles sandy loam, 2 to 6 percent slopes	33,560	7.3
42C	Riddles sandy loam, 6 to 12 percent slopes	12,950	2.8
42D	Riddles sandy loam, 12 to 18 percent slopes	2,905	0.6
43A	Dixboro very fine sandy loam, 0 to 3 percent slopes	9,475	2.1
44B	Leoni gravelly sandy loam, 2 to 6 percent slopes	4,545	1.0
44C	Leoni gravelly sandy loam, 6 to 12 percent slopes	3,720	0.8
44D	Leoni gravelly sandy loam, 12 to 18 percent slopes	1,350	0.3
45	Martisco muck	2,110	0.5
46	Sebewa loam	4,155	0.9
47	Histosols and Aquents, ponded	5,420	1.2
48	Napoleon muck	3,670	0.8
49B	Hillsdale-Riddles sandy loams, 1 to 6 percent slopes	43,020	9.4
49C	Hillsdale-Riddles sandy loams, 6 to 12 percent slopes	23,080	5.0
49D	Hillsdale-Riddles sandy loams, 12 to 18 percent slopes	5,045	1.1
49E	Hillsdale-Riddles sandy loams, 18 to 30 percent slopes	4,840	1.1
51	Udorthents and Udipsamments, nearly level	3,155	0.7
52	Pits, gravel	1,115	0.2
53	Pits, quarries	105	*
55B	Eleva sandy loam, 1 to 6 percent slopes	5,095	1.1
55C	Eleva sandy loam, 6 to 12 percent slopes	1,065	0.2
56D	Riddles-Leoni complex, 10 to 20 percent slopes	1,720	0.4
57A	Urban land-Barry-Brady complex, 0 to 3 percent slopes	2,130	0.5
58B	Urban land-Oshtemo complex, 0 to 6 percent slopes	3,720	0.8
58C	Urban land-Oshtemo complex, 6 to 15 percent slopes	1,040	0.2
59B	Urban land-Riddles complex, 0 to 6 percent slopes	1,565	0.3
59C	Urban land-Riddles complex, 6 to 15 percent slopes	440	0.1
60	Urban land-Udorthents complex	1,650	0.4
61B	Saylesville silt loam, 2 to 8 percent slopes	520	0.1
62A	Del Rey silt loam, 0 to 3 percent slopes	1,015	0.2
63	Henrietta muck	4,155	0.9
64B	Marlette-Owosso complex, 2 to 6 percent slopes	4,530	1.0
64C	Marlette-Owosso complex, 6 to 12 percent slopes	2,065	0.5
65A	Capac loam, 0 to 3 percent slopes	3,055	0.7
66E	Eleva Variant channery fine sandy loam, 15 to 30 percent slopes	440	0.1
67B	Whalan loam, 1 to 6 percent slopes	420	0.1
68B	Oshtemo-Leoni complex, 1 to 6 percent slopes	3,290	0.7
68C	Oshtemo-Leoni complex, 6 to 12 percent slopes	2,050	0.4
	Water	5,025	1.1
	Total	458,880	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Corn silage	Oats	Winter wheat	Soybeans	Grass-legume hay
	Bu	Ton	Bu	Bu	Bu	Ton
11B-----------------------Boyer-Oshtemo	80	13	60	35	30	3.0
11C-----------------------Boyer-Oshtemo	75	12	55	32	26	2.7
11D-----------------------Boyer-Oshtemo	65	11	51	27	21	2.3
11E-----------------------Boyer-Leoni	---	---	---	---	---	---
13B-----------------------Ormas-Spinks	63	9	60	30	24	2.4
13C-----------------------Ormas-Spinks	56	8	55	29	21	2.1
13D-----------------------Ormas-Spinks	---	---	---	25	---	1.7
14B-----------------------Spinks	65	9	60	30	27	3.0
14C-----------------------Spinks	57	8	55	30	23	2.4
14D-----------------------Spinks	---	---	---	---	---	1.8
15A-----------------------Teasdale	105	17	90	50	33	4.8
16A-----------------------Brady	80	12	60	35	30	3.0
17------------------------Barry	110	17	95	55	35	4.5
18------------------------Gilford-Colwood	109	17	81	55	37	4.6
20------------------------Houghton	115	20	---	---	34	---
22------------------------Cohoctah	---	---	---	---	---	3.5
29A-----------------------Kibbie	110	18	80	50	40	4.0
30------------------------Edwards	90	15	---	---	34	---
35B-----------------------Arkport-Okee	81	16	68	45	30	3.5
35C-----------------------Arkport-Okee	68	12	55	42	26	3.0
35D-----------------------Arkport-Okee	55	10	45	---	---	2.7
37------------------------Palms	105	17	65	---	42	---

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Winter wheat	Soybeans	Grass-legume hay
	Bu	Ton	Bu	Bu	Bu	Ton
39A------------------------ Ypsi-Wauseon	108	17	84	52	40	3.9
40------------------------ Lenawee	125	19	100	60	42	4.0
42A------------------------ Riddles	120	19	90	48	42	4.0
42B------------------------ Riddles	115	18	88	46	40	3.8
42C------------------------ Riddles	105	17	84	42	37	3.4
42D------------------------ Riddles	90	---	---	36	32	3.0
43A. Dixboro						
44B------------------------ Leoni	70	12	50	30	28	2.5
44C------------------------ Leoni	65	11	45	28	24	2.2
44D------------------------ Leoni	50	10	40	24	21	2.0
45------------------------ Martisco	90	18	---	---	---	---
46------------------------ Sebewa	105	17	90	50	36	4.6
47------------------------ Histosols and Aquents	---	---	---	---	---	---
48------------------------ Napoleon	---	---	---	---	---	---
49B------------------------ Hillsdale-Riddles	103	17	90	43	37	3.9
49C------------------------ Hillsdale-Riddl[redacted]	91	16	86	38	34	3.6
49D------------------------ Hillsdale-Riddles	79	---	75	33	31	3.1
49E------------------------ Hillsdale-Riddles	---	---	---	---	---	2.8
51------------------------ Udorthents and Udipsamments	---	---	---	---	---	---
52, 53. Pits						
55B------------------------ Eleva	75	12	65	---	---	4.0
55C------------------------ Eleva	75	12	65	---	---	4.0
56D------------------------ Riddles-Leoni	76	---	---	32	28	2.7

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Winter wheat	Soybeans	Grass-legume hay
	Bu	Ton	Bu	Bu	Bu	Ton
57A. Urban land-Barry-Brady	---	---	---	---	---	---
58B. Urban land-Oshtemo	---	---	---	---	---	---
58C. Urban land-Oshtemo	---	---	---	---	---	---
59B. Urban land-Riddles	---	---	---	---	---	---
59C. Urban land-Riddles	---	---	---	---	---	---
60. Urban land-Udorthents	---	---	---	---	---	---
61B. Sayleaville	110	18	75	55	35	5.0
62A. Del Rey	115	---	69	49	37	4.5
63. Henrietta	130	20	110	65	45	5.0
64B. Marlette-Owosso	103	17	77	49	35	3.9
64C. Marlette-Owosso	87	15	75	45	35	3.6
65A. Capac	120	18	100	65	40	4.0
66E. Eleva Variant	---	---	---	---	---	2.5
67B. Whalan	80	12	60	---	24	4.0
68B. Oshtemo-Leoni	76	12	56	33	29	2.5
68C. Oshtemo-Leoni	71	12	50	30	25	2.3

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	3,460	---	---	---
II	176,030	94,250	81,780	---
III	209,220	72,935	60,520	75,765
IV	24,695	16,195	8,500	---
V	3,445	---	3,445	---
VI	15,840	11,730	3,670	440
VII	825	825	---	---
VIII	5,420	---	5,420	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordi-nation symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Common trees	Site index	
11B*, 11C*, 11D*:								
Boyer	2o	Slight	Slight	Slight	Slight	Northern red oak	66	Eastern white pine, red pine, white spruce.
						White oak	---	
						American basswood	---	
						Sugar maple	---	
Oshtemo	2o	Slight	Slight	Slight	Slight	Northern red oak	66	Eastern white pine, red pine, white spruce.
						White oak	---	
						American basswood	66	
						Sugar maple	61	
11E*:								
Boyer	2r	Moderate	Moderate	Slight	Slight	Northern red oak	66	Eastern white pine, red pine, white spruce.
						White oak	---	
						American basswood	---	
						Sugar maple	---	
Leoni	2r	Moderate	Moderate	Slight	Slight	Northern red oak	65	Red pine, eastern white pine, white spruce, Austrian pine.
						White oak		
						American basswood	65	
						Sugar maple	61	
						White ash	65	
						Black walnut	65	
						Black cherry	---	
13B*, 13C*, 13D*:								
Ormas	2s	Slight	Slight	Moderate	Slight	Black oak	65	Black walnut, Norway spruce, red pine, eastern white pine, yellow-poplar.
						White oak	66	
						Bigtooth aspen	75	
						Black cherry	--	
						Yellow-poplar	---	
Spinks	2s	Slight	Slight	Moderate	Slight	Northern red oak	66	Red pine, eastern white pine.
						White oak	66	
						Shagbark hickory	66	
						Black oak	66	
						Black cherry	66	
14B, 14C Spinks	2s	Slight	Slight	Severe	Slight	Northern red oak	66	Red pine, eastern white pine.
						White oak	66	
						Shagbark hickory	66	
						Black oak	66	
						Black cherry	66	
14D Spinks	2s	Moderate	Moderate	Severe	Slight	Northern red oak	66	Red pine, eastern white pine.
						White oak	66	
						Shagbark hickory	66	
						Black oak	66	
						Black cherry	66	
15A Teasdale	2o	Slight	Slight	Slight	Slight	Northern red oak	66	White spruce, eastern white pine.
						Red maple	66	
						White ash	66	
						Eastern cottonwood	101	
						American basswood	---	
						Northern pin oak	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
16A----------------- Brady	3o	Slight	Slight	Slight	Slight	Red maple------------	56	White spruce, northern white-cedar, eastern white pine, Norway spruce.
						White ash------------	56	
						Quaking aspen--------	60	
						Silver maple---------	82	
						Bitternut hickory----	---	
						Swamp white oak------	---	
						American basswood----	56	
17------------------ Barry	3w	Slight	Severe	Severe	Severe	Red maple------------	56	Carolina poplar, eastern white pine.
						White ash------------	56	
						Eastern cottonwood---	91	
						Silver maple---------	82	
						Swamp white oak------	---	
						American sycamore----	---	
						Bitternut hickory----	---	
						Pin oak--------------	---	
18*: Gilford------------	3w	Slight	Severe	Severe	Severe	Red maple------------	56	Eastern white pine, Norway spruce, white spruce.
						Silver maple---------	---	
						American basswood----	---	
						Pin oak--------------	---	
						White ash------------	---	
						Swamp white oak------	---	
						Bur oak--------------	---	
Colwood------------	3w	Slight	Severe	Severe	Severe	Red maple------------	56	Eastern white pine.
						White ash------------	56	
						Silver maple---------	82	
						Green ash------------	56	
						Swamp white oak------	56	
20------------------ Houghton	3w	Slight	Severe	Severe	Severe	Red maple------------	56	
						Silver maple---------	82	
						White ash------------	56	
						Quaking aspen--------	60	
						Tamarack-------------	45	
						Green ash------------	---	
						Northern white-cedar	27	
						Swamp white oak------	---	
22------------------ Cohoctah	3w	Slight	Severe	Severe	Severe	Red maple------------	56	Carolina poplar, eastern white pine.
						Eastern cottonwood---	91	
						Silver maple---------	82	
						White ash------------	66	
						Swamp white oak------	---	
						American sycamore----	---	
						Pin oak--------------	---	
						Bitternut hickory----	---	
29A----------------- Kibbie	2o	Slight	Slight	Slight	Slight	Northern red oak-----	66	White spruce, eastern white pine, Norway spruce.
						White oak------------	---	
						White ash------------	66	
						American basswood----	66	
						Quaking aspen--------	70	
						Pin oak--------------	---	
						Sugar maple----------	---	
30------------------ Edwards	3w	Slight	Severe	Severe	Severe	Red maple------------	56	
						White ash------------	56	
						Green ash------------	56	
						Black cherry---------	---	
						Swamp white oak------	---	
						Silver maple---------	82	
						Tamarack-------------	45	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
35B*, 35C*:								
Arkport	2s	Slight	Slight	Moderate	Slight	Sugar maple	70	Norway spruce, red pine, eastern white pine.
						Red pine	85	
						Eastern white pine	85	
Okee	3s	Slight	Slight	Moderate	Slight	Northern pin oak	55	Red pine.
						Black oak	---	
35D*:								
Arkport	2s	Moderate	Moderate	Moderate	Slight	Sugar maple	70	Norway spruce, eastern white pine, red pine.
						Eastern white pine	85	
						Red pine	85	
						Northern red oak	75	
Okee	3s	Moderate	Moderate	Moderate	Slight	Northern pin oak	55	Red pine.
						Black oak	---	
37 Palms	3w	Slight	Severe	Severe	Severe	Red maple	55	
						Silver maple	76	
						White ash	51	
						Quaking aspen	56	
						Northern white-cedar	27	
						Tamarack	45	
						Black ash	---	
39A*:								
Ypsi	3o	Slight	Slight	Slight	Slight	Northern red oak	56	Eastern white pine, white spruce.
						White ash	56	
						White oak	---	
						American basswood	56	
						Red maple	---	
						Eastern cottonwood	---	
Wauseon	3w	Slight	Severe	Severe	Severe	Silver maple	70	White spruce.
						White ash	---	
						Swamp white oak	---	
40 Lenawee	3w	Slight	Severe	Severe	Moderate	Red maple	66	White spruce, Norway spruce, eastern white pine.
						White ash	66	
						American basswood	66	
						Silver maple	81	
42A, 42B, 42C, 42D Riddles	2o	Slight	Slight	Slight	Slight	Northern red oak	65	Red pine, white spruce.
						Red maple	65	
						White ash	65	
						Green ash	65	
43A Dixboro	2o	Slight	Slight	Slight	Slight	Northern red oak	65	Eastern white pine, white spruce.
						White oak	---	
						Northern pin oak	---	
						Black oak	---	
						Shagbark hickory	---	
44B, 44C, 44D Leoni	2o	Slight	Slight	Slight	Slight	Northern red oak	65	Red pine, eastern white pine, white spruce.
						White oak	---	
						American basswood	65	
						Sugar maple	61	
						White ash	65	
						Black walnut	65	
						Black cherry	---	
45 Martisco	5w	Slight	Severe	Severe	Severe	Red maple	40	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
46 Sebewa	2w	Slight	Severe	Moderate	Moderate	Red maple	66	White spruce, eastern white pine, Norway spruce.
						White ash	66	
						American basswood	---	
						Swamp white oak	---	
						Pin oak	66	
						Northern red oak	66	
48 Napoleon	3w	Slight	Severe	Severe	Severe	Red maple	56	
						Silver maple	76	
						White ash	56	
						Quaking aspen	60	
						Tamarack	45	
						Green ash	56	
49B*, 49C*, 49D*: Hillsdale	2o	Slight	Slight	Slight	Slight	Northern red oak	66	Black walnut, eastern white pine, white spruce, red pine, yellow-poplar.
						Black walnut	---	
						White ash	---	
						Sugar maple	---	
						Black cherry	---	
						American basswood	---	
						Yellow-poplar	---	
Riddles	2o	Slight	Slight	Slight	Slight	Northern red oak	65	Black walnut, red pine, white spruce.
						Red maple	65	
						White ash	65	
						Green ash	65	
						Black walnut	---	
						Yellow-poplar	---	
49E*: Hillsdale	2r	Moderate	Moderate	Slight	Slight	Northern red oak	65	Black walnut, eastern white pine, white spruce, red pine, yellow-poplar.
						Black walnut	---	
						White ash	---	
						Sugar maple	---	
						Black cherry	---	
						American basswood	---	
						Yellow-poplar	---	
Riddles	2r	Moderate	Moderate	Slight	Slight	Northern red oak	65	Black walnut, red pine, white spruce.
						Red maple	65	
						White ash	65	
						Green ash	65	
						Black walnut	---	
						Yellow-poplar	---	
55B, 55C Eleva	2o	Slight	Slight	Slight	Slight	Black oak	65	Red pine.
						Jack pine	---	
						Northern pin oak	---	
						Northern red oak	---	
56D*: Riddles	2o	Slight	Slight	Slight	Slight	Northern red oak	65	Black walnut, red pine, white spruce.
						Red maple	65	
						White ash	65	
						Green ash	65	
						Black walnut	---	
						Yellow-poplar	---	
Leoni	2o	Slight	Slight	Slight	Slight	Northern red oak	65	Red pine, eastern white pine, white spruce.
						White oak	---	
						American basswood	65	
						Sugar maple	61	
						White ash	65	
						Black walnut	65	
						Black cherry	---	
61B Saylesville	2o	Slight	Slight	Slight	Slight	Northern red oak	65	Eastern white pine, red pine, white spruce.
						Sugar maple	---	
						American basswood	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
62A----------------- Del Rey	3c	Slight	Slight	Severe	Severe	Northern red oak----	56	Northern red oak, northern white-cedar, white spruce, eastern white pine.
						White ash-----------	56	
						Red maple-----------	56	
						White oak-----------	56	
						American basswood---	56	
63------------------ Henrietta	3w	Slight	Severe	Severe	Severe	White ash-----------	56	Northern white-cedar.
						Red maple-----------	56	
						Yellow birch--------	54	
						American basswood---	56	
						Tamarack------------	49	
						Northern white-cedar	---	
						Swamp white oak-----	---	
						Pin oak-------------	---	
						Green ash-----------	---	
64B*, 64C*:								
Marlette------------	2o	Slight	Slight	Slight	Slight	Sugar maple---------	61	White spruce, eastern white pine, black walnut.
						Northern red oak----	---	
						White ash-----------	---	
						Black walnut--------	---	
						American basswood---	---	
						Black cherry--------	---	
						White oak-----------	---	
Owosso--------------	2o	Slight	Slight	Slight	Slight	Northern red oak----	65	Black walnut, white spruce, eastern white pine.
						Black cherry--------	---	
						White ash-----------	65	
						Sugar maple---------	61	
						American basswood---	65	
						White oak-----------	---	
						Yellow-poplar-------	65	
65A----------------- Capac	3o	Slight	Slight	Slight	Slight	Sugar maple---------	56	Eastern white pine, white spruce, Norway spruce, northern white-cedar.
						Northern red oak----	56	
						American basswood---	56	
						Northern pin oak----	---	
						Shagbark hickory----	---	
						White ash-----------	56	
						Red maple-----------	56	
						Bitternut hickory---	---	
66E----------------- Eleva Variant	2r	Slight	Severe	Slight	Slight	Northern red oak----	66	Eastern white pine, red pine, white spruce.
						Sugar maple---------	61	
						Red maple-----------	64	
						Eastern cottonwood--	100	
67B----------------- Whalan	2o	Slight	Slight	Slight	Slight	Eastern white pine--	58	Eastern white pine.
						Northern red oak----	60	
						White oak-----------	60	
						Black walnut--------	55	
68B*, 68C*:								
Oshtemo-------------	2o	Slight	Slight	Slight	Slight	Northern red oak----	66	Eastern white pine, red pine, white spruce.
						White oak-----------	---	
						American basswood---	66	
						Sugar maple---------	61	
Leoni---------------	2o	Slight	Slight	Slight	Slight	Northern red oak----	65	Red pine, eastern white pine, white spruce, black walnut.
						White oak-----------	---	
						American basswood---	65	
						Sugar maple---------	61	
						White ash-----------	65	
						Black walnut--------	65	
						Black cherry--------	---	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than, > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
11B*, 11C*, 11D*. Boyer	Vanhoutte spirea, silky dogwood.	Autumn-olive, Tatarian honeysuckle, lilac, Amur privet.	Eastern redcedar, hawthorn, white spruce.	Eastern white pine, red pine, Norway spruce.	Carolina poplar.
Oshtemo	Vanhoutte spirea, silky dogwood.	Autumn-olive, Tatarian honeysuckle, white spruce.	Austrian pine, white spruce.	Eastern white pine, red pine.	Carolina poplar.
11E*: Boyer	Vanhoutte spirea, silky dogwood.	Autumn-olive, Tatarian honeysuckle, lilac.	Eastern redcedar hawthorn, white spruce.	Eastern white pine, Norway spruce, red pine.	Carolina poplar.
Leoni	Vanhoutte spirea, silky dogwood.	Autumn-olive, Tatarian honeysuckle, whitebelle honeysuckle, lilac, white spruce, silky dogwood.	Austrian pine, eastern redcedar.	Eastern white pine, Norway spruce, red pine.	Carolina poplar.
13B*, 13C*, 13D*: Ormas	Vanhoutte spirea	Autumn olive, lilac, Tatarian honeysuckle, Amur privet.	Siberian crabapple, eastern redcedar.	Red pine, eastern white pine, Norway spruce.	Carolina poplar.
Spinks	Vanhoutte spirea	White spruce, Tatarian honeysuckle, Amur privet, autumn-olive.	Eastern redcedar, Austrian pine.	Eastern white pine, red pine, Norway spruce.	Carolina poplar.
14B, 14C, 14D Spinks	Vanhoutte spirea	White spruce, Tatarian honeysuckle, Amur privet, autumn-olive.	Eastern redcedar, Austrian pine.	Eastern white pine, red pine.	Carolina poplar.
15A Teasdale	---	American cranberrybush, lilac.	White spruce, northern white-cedar.	Eastern white pine, Norway spruce.	Carolina poplar.
16A Brady	---	Silky dogwood, whitebelle honeysuckle, Tatarian honeysuckle.	White spruce, northern white cedar, eastern white pine, blue spruce.	Norway spruce, red pine.	Carolina poplar, green ash.
17 Barry	Vanhoutte spirea	Redosier dogwood, silky dogwood, Amur honeysuckle, Amur privet.	White spruce, northern white-cedar.	Norway spruce	Carolina poplar, green ash.
18*. Gilford.					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
18*: Colwood	---	Siberian crabapple, silky dogwood, Tatarian honeysuckle, Amur privet, arrowwood, hawthorn.	Northern white-cedar, white spruce.	Norway spruce, eastern white pine.	Carolina poplar.
20. Houghton	Vanhoutte spirea	Silky dogwood, Amur privet, white spruce, redosier dogwood.	Northern white-cedar.	Norway spruce, eastern white pine.	Carolina poplar.
22. Conoctah	Vanhoutte spirea	Amur privet, silky dogwood, Amur honeysuckle, redosier dogwood.	Northern white-cedar, Siberian crabapple, white spruce.	Eastern white pine, Norway spruce, green ash.	Carolina poplar.
29A. Kibbie	---	Silky dogwood, white spruce, blue spruce, American cranberrybush.	Northern white-cedar, eastern white pine.	Norway spruce	Carolina poplar.
30. Edwards	---	Amur privet, redosier dogwood, silky dogwood.	Northern white-cedar, nannyberry viburnum.	Norway spruce	Carolina poplar.
35B*, 35C*, 35D*. Arkport	Vanhoutte spirea	Autumn-olive, Tatarian honeysuckle, Amur privet.	Northern white-cedar, white spruce.	Red pine, eastern white pine, Norway spruce.	Carolina poplar.
Okee	Vanhoutte spirea	Lilac	Austrian pine, Siberian crabapple.	Eastern white pine, red pine.	---
37. Palms	Vanhoutte spirea	Silky dogwood, Tatarian honeysuckle, American cranberrybush, white spruce.	Tamarack, northern white-cedar.	Norway spruce, eastern white pine.	Carolina poplar.
39A*: Ypsi	---	Silky dogwood, Amur privet, Tatarian honeysuckle.	Eastern white pine, white spruce, northern white cedar.	Norway spruce	Carolina poplar.
Wauseon	---	Redosier dogwood, silky dogwood.	Northern white-cedar, medium purple willow.	Eastern white pine, Norway spruce.	Carolina poplar, green ash.
40. Lenawee	---	Silky dogwood, redosier dogwood.	Eastern white pine, white spruce.	Norway spruce	Green ash, Carolina poplar.
42A, 42B, 42C, 42D. Riddles		Autumn-olive, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce.	Norway spruce, red pine.	Carolina poplar.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
43A. Dixboro	---	Lilac, Amur honeysuckle, Amur privet, silky dogwood.	Eastern white pine, northern white-cedar.	Norway spruce	Carolina poplar.
44B, 44C, 44D. Leoni	---	Autumn-olive, Tatarian honeysuckle, lilac, silky dogwood.	Austrian pine, eastern redcedar, white spruce.	Eastern white pine, Norway spruce, red pine.	---
45. Martisco					
46. Sebewa	---	Silky dogwood, Amur privet.	White spruce, northern white-cedar.	Norway spruce, eastern white pine.	Carolina poplar, green ash.
47*: Histosols.					
Aquents.					
48. Napoleon	---	Silky dogwood, white spruce.	Northern white-cedar.	Eastern white pine, Norway spruce.	Carolina poplar.
49B*, 49C*, 49D*, 49E*: Hillsdale	---	Lilac, autumn-olive.	White spruce, red pine.	Eastern white pine	Carolina poplar.
Riddles	---	Autumn-olive	Northern white-cedar, white spruce.	Norway spruce, red pine.	Carolina poplar.
51* Udorthents.					
Udipsamments.					
52*, 53*. Pits					
55B, 55C. Eleva	Manyflower cotoneaster.	Siberian peashrub, lilac, Siberian crabapple, Tatarian honeysuckle.	Eastern redcedar, northern white-cedar.	Green ash, eastern white pine, Norway spruce.	Carolina poplar.
56D*. Riddles	---	Autumn olive	Northern white-cedar, white spruce.	Norway spruce, red pine.	Carolina poplar.
Leoni	---	Autumn-olive, Tatarian honeysuckle, whitebelle honeysuckle, lilac, white spruce, silky dogwood.	Austrian pine, eastern redcedar.	Eastern white pine, Norway spruce, red pine.	--

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
57A*: Urban land.					
Barry	Vanhoutte spirea	Redosier dogwood, silky dogwood, Amur honeysuckle, Amur privet.	White spruce, northern white-cedar.	Norway spruce	Carolina poplar, green ash.
Brady	---	Silky dogwood, whitebelle honeysuckle, Tatarian honeysuckle.	White spruce, northern white-cedar, blue spruce.	Norway spruce, red pine, eastern white pine.	Carolina poplar, green ash.
58B*, 58C*. Urban land.					
Oshtemo	Vanhoutte spirea, silky dogwood.	Autumn-olive, Tatarian honeysuckle.	---	Eastern white pine, red pine.	Carolina poplar.
59B*, 59C*. Urban land.					
Riddles	---	Autumn-olive	Northern white-cedar, white spruce.	Norway spruce	Carolina poplar.
60*. Urban land.					
Udorthents.					
61B Saylesville	---	Northern white cedar, lilac, common ninebark, silky dogwood.	White spruce, Austrian pine.	Eastern white pine, red pine.	---
62A Del Rey	Vanhoutte spirea	Tatarian honeysuckle, American cranberrybush, Amur privet, lilac, blue spruce.	White spruce	Eastern white pine, Norway spruce.	Green ash, Carolina poplar.
63 Henrietta	---	Silky dogwood, redosier dogwood.	Northern white-cedar, white spruce.	Eastern white pine.	Carolina poplar, green ash.
64B*, 64C*: Marlette	---	Autumn-olive, lilac, silky dogwood.	Austrian pine, white spruce.	Red pine, eastern white pine, Norway spruce.	Carolina poplar, green ash.
Owosso	Silky dogwood, Vanhoutte spirea.	Lilac, Tatarian honeysuckle, Amur privet.	White spruce, Austrian pine.	Eastern white pine, Norway spruce.	Carolina poplar, green ash.
65A Capac	---	Silky dogwood, American cranberrybush.	White spruce, northern white-cedar.	Norway spruce, eastern white pine.	Carolina poplar, green ash.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
66E: Eleva Variant	---	Lilac, autumn-olive, Amur honeysuckle.	Northern white-cedar, Siberian crabapple.	White ash, eastern white pine.	---
67B: Whalan		Siberian crabapple, Tatarian honeysuckle, lilac.	Eastern redcedar, white spruce.	Green ash, eastern white pine, red pine.	---
68B*, 68C*: Oshtemo	Vanhoutte spirea, silky dogwood.	Autumn-olive, Tatarian honeysuckle.	White spruce, Austrian pine.	Eastern white pine, red pine.	Carolina poplar.
Leoni	---	Autumn-olive, Tatarian honeysuckle, whitebelle honeysuckle, lilac, silky dogwood.	Austrian pine, eastern redcedar, white spruce.	Eastern white pine, Norway spruce.	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
11B*:					
Boyer	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
Oshtemo	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
11C*:					
Boyer	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
Oshtemo	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, slope.
11D*:					
Boyer	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Oshtemo	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
11E*:					
Boyer	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Leoni	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
13B*:					
Ormas	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Spinks	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
13C*:					
Ormas	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
Spinks	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
13D*:					
Ormas	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Spinks	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
14B Spinks	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
14C: Spinks	Severe: too sandy.	Severe: too sandy.	Severe slope, too sandy.	Severe. too sandy.	Moderate: droughty, slope, too sandy.
14D: Spinks	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe. slope, too sandy.	Severe; too sandy.	Severe slope.
15A: Teasdale	Severe: wetness.	Severe: wetness.	Severe wetness.	Severe: wetness.	Severe wetness.
16A: Brady	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
17: Barry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe. ponding.	Severe ponding.
18*:					
Gilford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe. ponding.
Colwood	Severe: ponding.	Severe: ponding.	Severe. ponding.	Severe: ponding.	Severe: ponding.
20: Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe. ponding, excess humus.	Severe: ponding, excess humus.	Severe. excess humus, ponding.
22: Cohoctah	Severe. floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness
29A: Kibbie	Severe. wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate wetness.
30: Edwards	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe ponding, excess humus.	Severe: excess humus, ponding.
35B*:					
Arkport	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: too sandy.
Okee	Slight	Slight	Moderate. slope.	Slight	Slight.
35C*:					
Arkport	Moderate slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: slope, too sandy.
Okee	Moderate slope.	Moderate, slope.	Severe: slope.	Slight	Moderate: slope.
35D*:					
Arkport	Severe: slope.	Severe: slope.	Severe: slope.	Moderate. slope, too sandy.	Severe: slope.
Okee	Severe: slope.	Severe slope.	Severe: slope.	Moderate: slope.	Severe. slope.
37: Palms	Severe: ponding, floods, excess humus.	Severe. ponding, excess humus.	Severe: ponding, floods, excess humus.	Severe: ponding, excess humus.	Severe: ponding, floods, excess humus.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
39A*:					
Ypsi	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Wauseon	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
40 Lenawee	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
42A Riddles	Slight	Slight	Moderate: small stones.	Slight	Slight.
42B Riddles	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
42C Riddles	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
42D Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
43A Dixboro	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
44B Leoni	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones, droughty.
44C Leoni	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.
44D Leoni	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
45 Martisco	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
46 Sebewa	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
47*:					
Histosols.					
Aquents.					
48 Napoleon	Severe: ponding, excess humus, too acid.	Severe: ponding, excess humus, too acid.	Severe: excess humus, ponding, too acid.	Severe: ponding, excess humus.	Severe: too acid, ponding, excess humus.
49B*:					
Hillsdale	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
Riddles	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
49C*:					
Hillsdale	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Riddles	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
49D*, 49E*:					
Hillsdale	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
51*:					
Udorthents.					
Udipsamments.					
52*, 53*. Pits					
55B Eleva	Slight	Slight	Moderate: depth to rock, slope, small stones.	Slight	Moderate: thin layer.
55C Eleva	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, thin layer.
56D*:					
Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Leoni	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
57A*:					
Urban land.					
Barry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Brady	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
58B*:					
Urban land.					
Oshtemo	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
58C*:					
Urban land.					
Oshtemo	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, slope.
59B*:					
Urban land.					
Riddles	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
59C*:					
Urban land.					
Riddles	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
60*:					
Urban land.					
Udorthents.					
61B Saylesville	Moderate. percs slowly.	Moderate. percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
62A Del Rey	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
63 Henrietta	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe. excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
64B*:					
Marlette	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
Owosso	Moderate: percs slowly.	Moderate percs slowly.	Moderate: slope, small stones, percs slowly.	Slight	Slight.
64C*:					
Marlette	Moderate. slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Owosso	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate. slope.
65A Capac	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate wetness.	Moderate. wetness.
66E Eleva Variant	Severe: slope.	Severe, slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
67B Whelan	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, depth to rock, percs slowly.	Slight	Moderate: thin layer.
68B*					
Oshtemo	Moderate: small stones.	Moderate: small stones.	Severe. small stones.	Slight	Moderate: small stones.
Leoni	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones, droughty.
68C*					
Oshtemo	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate. small stones, slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
680*:					
Leoni	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
11B*:										
Boyer	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Oshtemo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
11C*:										
Boyer	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Oshtemo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
11D*:										
Boyer	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Oshtemo	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
11E*:										
Boyer	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Leoni	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
13B*:										
Ormas	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Spinks	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
13C*, 13D*:										
Ormas	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Spinks	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
14B Spinks	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
14C, 14D Spinks	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
15A Teasdale	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
16A Brady	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
17 Barry	Good	Good	---	Fair	Fair	---	---	Good	Fair	---
18*:										
Gilford	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Colwood	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
20----------------- Houghton	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
22----------------- Cohoctah	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
29A ---------------- Kibbie	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair.
30----------------- Edwards	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
35B*:										
Arkport------------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Okee---------------	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
35C*:										
Arkport------------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Okee---------------	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
35D*:										
Arkport------------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Okee---------------	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
37----------------- Palms	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Poor.
39A*:										
Ypsi---------------	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Wauseon------------	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
40----------------- Lenawee	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
42A, 42B----------- Riddles	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
42C---------------- Riddles	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
42D---------------- Riddles	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
43A---------------- Dixboro	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
44B---------------- Leoni	Poor	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
44C---------------- Leoni	Poor	Good	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
44D---------------- Leoni	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
45: Martisco	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
46: Sebewa	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
47*:										
Histosols.										
Aquents.										
48: Napoleon	Very poor.	Very poor.	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good.
49B*:										
Hillsdale	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Riddles	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
49C*:										
Hillsdale	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Riddles	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
49D*:										
Hillsdale	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Riddles	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
49B*:										
Hillsdale	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Riddles	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
51*:										
Udorthents.										
Udipsamments.										
52*, 53*. Pits										
55B, 55C: Eleva	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
56D*:										
Riddles	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Leoni	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
57A*:										
Urban land.										
Barry	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Brady	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
58B*. Urban land.										
Oshtemo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
58C*: Urban land.										
Oshtemo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
59B*: Urban land.										
Riddles	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
59C*: Urban land.										
Riddles	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
60*: Urban land.										
Udorthents.										
61B Saylesville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
62A Del Rey	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
63 Henrietta	Fair	Good	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
64B*: Marlette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Owosso	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
64C*: Marlette	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Owosso	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
65A Capac	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair.
66E Eleva Variant	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor
67B Whalan	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
68B*: Oshtemo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
68B*										
Leoni	Poor	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
68C*:										
Oshtemo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Leoni	Poor	Good	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
11B*:						
Boyer	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Oshtemo	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: small stones.
11C*:						
Boyer	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Oshtemo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope.
11D*:						
Boyer	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Oshtemo	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
11E*:						
Boyer	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Leoni	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
13B*:						
Ormas	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
13C*:						
Ormas	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
13D*:						
Ormas	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
14B Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
14C: Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
14D: Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
15A: Teasdale	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
16A: Brady	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
17: Barry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
18*:						
Gilford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Colwood	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
20: Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
22: Cohoctah	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action, wetness.	Severe: floods, wetness.
29A: Kibbie	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
30: Edwards	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: excess humus, ponding.
35B*:						
Arkport	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: low strength.	Moderate: too sandy.
Okee	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
35C*:						
Arkport	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength.	Moderate: slope, too sandy.
Okee	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
35D*:						
Arkport	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
35D*:						
Okee	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
37 Palms	Severe: excess humus, ponding.	Severe: ponding, low strength, floods.	Severe: ponding, low strength, floods.	Severe: ponding, floods, low strength.	Severe: ponding, floods, frost action.	Severe: ponding, floods, excess humus.
39A*:						
Ypsi	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
Wauseon	Severe: ponding, cutbanks cave.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
40 Lenawee	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
42A Riddles	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
42B Riddles	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, frost action.	Slight.
42C Riddles	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
42D Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
43A Dixboro	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
44B Leoni	Severe: cutbanks cave.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, slope, large stones.	Moderate: shrink-swell, large stones.	Moderate: large stones, droughty.
44C Leoni	Severe: cutbanks cave.	Moderate: shrink-swell, slope, large stones.	Moderate: slope, shrink-swell, large stones.	Severe: slope.	Moderate: slope, shrink-swell, large stones.	Moderate: large stones, droughty, slope.
44D Leoni	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
45 Martisco	Severe: ponding, excess humus.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
46 Sebewa	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action.	Severe: ponding.
47*:						
Histosols.						

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
47*: Aquents.						
48 Napoleon	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: too acid, ponding, excess humus.
49B*: Hillsdale	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Riddles	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, frost action.	Slight.
49C*: Hillsdale	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Riddles	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
49D*, 49E*: Hillsdale	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
51*: Udorthents.						
Udipsamments.						
52*, 53*. Pits						
55B Eleva	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Moderate: thin layer.
55C Eleva	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, thin layer.
56D*: Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Leoni	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
57A*: Urban land.						
Barry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Brady	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
58B*: Urban land.						

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
58B*. Oshtemo	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate. small stones.
58C*: Urban land.						
Oshtemo	Severe: cutbanks cave.	Moderate: slope.	Moderate slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope.
59B*. Urban land.						
Riddles	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
59C*: Urban land.						
Riddles	Moderate. slope.	Moderate. slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe. slope.	Moderate: low strength, slope, frost action.	Moderate. slope.
60*: Urban land.						
Udorthents.						
61B Saylesville	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: shrink-swell, wetness.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
62A Del Rey	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe. wetness.	Severe: low strength, frost action.	Moderate: wetness.
63 Henrietta	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
64B*: Marlette	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
Owosso	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
64C*: Marlette	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate. slope.
Owosso	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe. slope.	Severe: low strength.	Moderate: slope.
65A Capac	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe wetness.	Severe: frost action, low strength.	Moderate: wetness.
66E Eleva Variant	Severe: slope.	Severe: slope.	Severe. slope.	Severe slope.	Severe. slope.	Severe. slope.
67B Whalan	Moderate: depth to rock, too clayey.	Slight	Moderate depth to rock.	Slight	Severe: low strength.	Moderate: thin layer.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
68B*:						
Oshtemo	Severe: cutbanks cave.	Slight	Slight	Moderate slope.	Slight	Moderate small stones.
Leoni	Severe: cutbanks cave.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, large stones.	Moderate shrink-swell, slope, large stones.	Moderate: shrink-swell, large stones.	Moderate: large stones, droughty.
68C*:						
Oshtemo	Severe: cutbanks cave.	Moderate. slope.	Moderate. slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope.
Leoni	Severe: cutbanks cave.	Moderate: shrink-swell, slope, large stones.	Moderate: slope, shrink-swell, large stones.	Severe: slope.	Moderate: slope, shrink-swell, large stones.	Moderate: large stones, droughty, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
11B*:					
Boyer	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Oshtemo	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
11C*:					
Boyer	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Oshtemo	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
11D*:					
Boyer	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Oshtemo	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, slope.
11E*:					
Boyer	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Leoni	Severe: slope.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
13B*:					
Ormas	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Spinks	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
13C*:					
Ormas	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Spinks	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
13D*:					
Ormas	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: thin layer, slope.

See footnote at end of table.

TABLE 1?.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
13D*:					
Spinks	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
14B Spinks	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
14C Spinks	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
14D Spinks	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
15A Teasdale	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
16A Brady	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
17 Barry	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.
18*:					
Gilford	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Colwood	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding, thin layer.
20 Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
22 Cohoctah	Severe: wetness, floods.	Severe: floods, seepage, wetness.	Severe: seepage, floods, wetness.	Severe: seepage, floods, wetness.	Poor: wetness.
29A Kibbie	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy, wetness.
30 Edwards	Severe: ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding, excess humus.
35B*:					
Arkport	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Okee	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
35C*:					
Arkport	Moderate slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: slope, too sandy.
Okee	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
35D*:					
Arkport	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope, seepage.	Poor: slope.
Okee	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
37 Palms	Severe: floods, subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, floods, excess humus.	Severe: ponding, floods, seepage.	Poor: ponding, excess humus.
39A*:					
Ypsi	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
Wauseon	Severe: percs slowly, ponding poor filter.	Severe: seepage, ponding.	Severe: ponding, too clayey.	Severe: ponding, seepage.	Poor. ponding, too clayey, hard to pack.
40 Lenawee	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
42A Riddles	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair. too clayey.
42B Riddles	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
42C Riddles	Moderate: slope.	Severe. slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
42D Riddles	Severe: slope.	Severe. slope.	Severe: slope.	Severe: slope.	Poor. slope.
43A Dixboro	Severe: wetness.	Severe wetness.	Severe: wetness, too sandy	Severe: seepage, wetness.	Poor: too sandy, wetness.
44B Leoni	Slight	Severe seepage, large stones.	Severe: seepage, large stones.	Severe: seepage.	Poor: large stones.
44C Leoni	Moderate: slope.	Severe. seepage, slope, large stones.	Severe: seepage, large stones.	Severe: seepage.	Poor: large stones.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
44D: Leoni	Severe: slope.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
45: Martisco	Severe: ponding, percs slowly.	Severe: ponding, excess humus.	Severe: ponding.	Severe: ponding.	Poor: ponding, excess humus.
46: Sebewa	Severe: poor filter, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: small stones, seepage, too sandy.
47*:					
Histosols.					
Aquents.					
48: Napoleon	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus, too acid.
49B*:					
Hillsdale	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Riddles	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
49C*:					
Hillsdale	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
Riddles	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
49D*, 49E*:					
Hillsdale	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
51*:					
Udorthents.					
Udipsamments.					
52*, 53*. Pits					
55B: Eleva	Severe: depth to rock, poor filter.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: seepage, depth to rock.	Poor: area reclaim.
55C: Eleva	Severe: depth to rock, poor filter.	Severe: slope, seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: seepage, depth to rock.	Poor: area reclaim.

See footnote at end of table.

TABLE 12. SANITARY FACILITIES Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
56D*:					
Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Leoni	Severe: slope.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
57A*:					
Urban land.					
Barry	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.
Brady	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
58B*:					
Urban land.					
Oshtemo	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
58C*:					
Urban land.					
Oshtemo	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
59B*:					
Urban land.					
Riddles	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
59C*:					
Urban land.					
Riddles	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
60*:					
Urban land.					
Udorthents.					
61B Saylesville	Severe: percs slowly, wetness.	Moderate: slope.	Moderate: too clayey, wetness.	Slight	Fair: too clayey.
62A Del Rey	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
63 Henrietta	Severe: ponding.	Severe: excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
64B*:					
Marlette	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 12. SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
64B*:					
Owosso	Severe: percs slowly.	Moderate: slope.	Slight	Severe: seepage.	Good.
64C*:					
Marlette	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
Owosso	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Severe: seepage.	Fair: slope.
65A Capac	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
66E Eleva Variant	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, seepage, small stones.
67B Whalan	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
68B*:					
Oshtemo	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
Leoni	Slight	Severe: seepage, large stones.	Severe: seepage, large stones.	Severe: seepage.	Poor: large stones.
68C*:					
Oshtemo	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
Leoni	Moderate: slope.	Severe: seepage, slope, large stones.	Severe: seepage, large stones.	Severe: seepage.	Poor: large stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
11B*, 11C*:				
Boyer	Good	Probable	Probable	Poor: small stones, area reclaim.
Oshtemo	Good	Probable	Probable	Poor: small stones.
11D*:				
Boyer	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Oshtemo	Fair: slope.	Probable	Probable	Poor: small stones, slope.
11E*:				
Boyer	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Leoni	Poor: slope.	Improbable: large stones.	Improbable: large stones.	Poor: large stones, area reclaim, slope.
13B*:				
Ormas	Good	Probable	Probable	Fair: too sandy, small stones.
Spinks	Good	Probable	Improbable: too sandy.	Poor: too sandy.
13C*:				
Ormas	Good	Probable	Probable	Fair: too sandy, small stones.
Spinks	Good	Probable	Improbable: too sandy.	Poor: too sandy.
13D*:				
Ormas	Fair: slope.	Probable	Probable	Poor: slope.
Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
14B, 14C Spinks	Good	Probable	Improbable: too sandy.	Poor: too sandy.
14D Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
15A Teasdale	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
16A: Brady	Fair: wetness.	Probable	Probable	Poor: small stones.
17: Barry	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
18*:				
Gilford	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Colwood	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
20: Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
22: Cohoctah	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
29A: Kibbie	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
30: Edwards	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
35B*, 35C*:				
Arkport	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Okee	Good	Probable	Probable	Poor: area reclaim.
35D*:				
Arkport	Fair: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too sandy.
Okee	Fair: slope.	Probable	Probable	Poor: area reclaim, slope.
37: Palms	Poor: wetness.	Improbable: excess humus, excess fines.	Improbable: excess humus, excess fines.	Poor: wetness, excess humus.
39A*:				
Ypsi	Fair: thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Wauseon	Poor: wetness, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
40: Lenawee	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
42A, 42B: Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
42C: Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
42D: Riddles	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
43A: Dixboro	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
44B, 44C: Leoni	Fair: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: large stones, area reclaim.
44D: Leoni	Fair: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: large stones, area reclaim, slope.
45: Martisco	Poor: wetness, excess humus.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
46: Sebewa	Poor: wetness.	Probable	Probable	Poor: wetness, small stones, area reclaim.
47*:				
Histosols.				
Aquents.				
48: Napoleon	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness, too acid.
49B*:				
Hillsdale	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
49C*:				
Hillsdale	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
49D*, 49E*:				
Hillsdale	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Riddles	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
51*:				
Udorthents.				
Udipsamments.				
52*, 53*: Pits				
55B: Eleva	Poor: area reclaim.	Improbable: thin layer.	Improbable: excess fines.	Fair: area reclaim, small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
55C----- Eleva	Poor: area reclaim.	Improbable: thin layer.	Improbable: excess fines.	Fair: slope, area reclaim, small stones.
56D*:				
Riddles	Fair, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Leoni	Fair: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: large stones, area reclaim, slope.
57A*: Urban land.				
Barry	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
Brady	Fair: wetness.	Probable	Probable	Poor: small stones.
58B*, 58C*: Urban land.				
Oshtemo	Good	Probable	Probable	Poor: small stones.
59B*: Urban land.				
Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
59C*: Urban land.				
Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
60*. Urban land.				
Udorthents.				
61B----- Saylesville	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
62A----- Del Rey	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
63----- Henrietta	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
64B*:				
Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Owosso	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
64C*:				
Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
Owosso	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
65A. Capac	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
66E. Eleva Variant	Poor: area reclaim.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, slope.
67B. Whalan	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
68B*, 68C*:				
Oshtemo	Good	Probable	Probable	Poor: small stones.
Leoni	Fair: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: large stones, area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
11B*:						
Boyer	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, soil blowing.	Droughty.
Oshtemo	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Favorable.
11C*, 11D*.						
Boyer	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, soil blowing.	Slope, droughty.
Oshtemo	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope.
11E*:						
Boyer	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, soil blowing.	Slope, droughty.
Leoni	Severe: seepage, slope.	Severe: large stones.	Severe: no water.	Deep to water	Large stones, droughty, slope.	Large stones, slope, droughty.
13B*:						
Ormas	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Droughty.
Spinks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Droughty.
13C*, 13D*:						
Ormas	Severe: seepage, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, droughty.
Spinks	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, droughty.
14B Spinks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Droughty.
14C, 14D Spinks	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, droughty.
15A Teasdale	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action	Wetness, soil blowing.	Wetness.
16A Brady	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action	Wetness, soil blowing.	Wetness.
17 Barry	Severe: seepage.	Severe: piping, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding	Wetness.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
18*:						
Gilford	Severe: seepage.	Severe: seepage, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, droughty.	Wetness, droughty.
Colwood	Moderate: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding	Wetness, erodes easily.
20 Houghton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Frost action, subsides, ponding.	Soil blowing, ponding.	Wetness.
22 Cohoctah	Severe: seepage.	Severe: piping, wetness.	Slight	Floods, frost action.	Wetness, soil blowing.	Wetness.
29A Kibbie	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness	Wetness, erodes easily.
30 Edwards	Severe: seepage.	Severe: ponding.	Severe: slow refill.	Frost action, ponding, subsides.	Ponding, soil blowing.	Wetness.
35B*:						
Arkport	Severe: seepage.	Severe: piping.	Severe: no water.	Not needed	Fast intake, seepage, slope.	Droughty.
Okee	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Fast intake, soil blowing.	Favorable.
35C*, 35D*:						
Arkport	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Not needed	Fast intake, seepage, slope.	Droughty.
Okee	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Fast intake, soil blowing.	Slope.
37 Palms	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Floods, ponding, subsides.	Ponding, soil blowing, floods.	Wetness.
39A*:						
Ypsi	Severe: seepage.	Severe: piping.	Severe: no water.	Percs slowly, frost action.	Wetness, soil blowing, percs slowly.	Wetness, percs slowly.
Wauseon	Severe: seepage.	Severe: ponding, hard to pack.	Severe: no water.	Percs slowly, frost action.	Ponding	Wetness, percs slowly.
40 Lenawee	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Wetness.
42A Riddles	Moderate: seepage.	Slight	Severe: no water.	Deep to water	Soil blowing	Favorable.
42B Riddles	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Slope, soil blowing.	Favorable.
42C, 42D Riddles	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.

See footnote at end of table.

TABLE 14.- WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
43A Dixboro	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness	Wetness.
44B Leoni	Severe: seepage.	Severe: large stones.	Severe: no water.	Deep to water	Large stones, droughty, slope.	Large stones, droughty.
44C, 44D Leoni	Severe: seepage, slope.	Severe: large stones.	Severe: no water.	Deep to water	Large stones, droughty, slope.	Large stones, slope, droughty.
45 Martisco	Severe: seepage.	Severe: wetness.	Severe: slow refill.	Percs slowly, poor outlets, wetness.	Wetness	Not needed.
46 Sebewa	Severe: seepage.	Severe: seepage, ponding.	Moderate: slow refill, cutbanks cave.	Frost action, cutbanks cave, ponding.	Ponding	Wetness.
47*: Histosols.						
Aquents.						
48 Napoleon	Severe: seepage.	Severe: excess humus, wetness.	Moderate: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing, too acid.	Wetness.
49B*: Hillsdale	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing	Favorable.
Riddles	Moderate: seepage, slope.	Slight	Severe. no water.	Deep to water	Slope, soil blowing.	Favorable.
49C*, 49D*, 49E*: Hillsdale	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing	Slope.
Riddles	Severe. slope.	Slight	Severe. no water.	Deep to water	Slope, soil blowing.	Slope.
51*: Udorthents.						
Udipsamments.						
52*, 53*. Pits						
55B Eleva	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing, depth to rock, slope.	Depth to rock.
55C Eleva	Severe: slope, seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing, depth to rock, slope.	Slope, depth to rock.
56D*: Riddles	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
Leoni	Severe: seepage, slope.	Severe: large stones.	Severe: no water.	Deep to water	Large stones, droughty, slope.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
57A*: Urban land.						
Barry	Severe: seepage.	Severe: piping, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding	Wetness.
Brady	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action	Wetness, soil blowing.	Wetness.
58B*: Urban land.						
Oshtemo	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Favorable.
58C*: Urban land.						
Oshtemo	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope.
59B*: Urban land.						
Riddles	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Slope, soil blowing.	Favorable.
59C*: Urban land.						
Riddles	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
60*: Urban land.						
Udorthents.						
61B Saylesville	Moderate: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Erodes easily.
62A Del Rey	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, erodes easily, percs slowly.
63 Henrietta	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Wetness.
64B*: Marlette	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Favorable.
Owosso	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Erodes easily.
64C*: Marlette	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope.
Owosso	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
65A: Capac	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill.	Frost action	Wetness	Wetness.
66E: Eleva Variant	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Droughty, depth to rock, slope.	Large stones, slope, droughty.
67B: Whalan	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Percs slowly, depth to rock, slope.	Depth to rock, percs slowly.
68B*:						
Oshtemo	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Favorable.
Leoni	Severe: seepage.	Severe: large stones.	Severe: no water.	Deep to water	Large stones, droughty, slope.	Large stones, droughty.
68C*:						
Oshtemo	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope.
Leoni	Severe: seepage, slope.	Severe: large stones.	Severe: no water.	Deep to water	Large stones, droughty, slope.	Large stones, slope, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
11B*, 11C*, 11D*:											
Boyer	0-11	Sandy loam	SM, SM-SC	A-2, A-4	0-5	95-100	75-95	60-75	25-40	<25	NP-7
	11-34	Sandy loam, loam, gravelly sandy loam.	SM, SC, SM-SC, SP-SM	A-2, A-4, A-6	0-5	80-100	65-95	55-85	10-45	10-35	NP-16
	34-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-100	30-70	0-10	---	NP
Oshtemo	0-17	Sandy loam	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	17-28	Gravelly sandy loam, gravelly sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	28-60	Stratified coarse sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
11E*:											
Boyer	0-11	Sandy loam	SM, SM-SC	A-2, A-4	0-5	95-100	75-95	60-75	25-40	<25	NP-7
	11-34	Sandy loam, loam, gravelly sandy loam.	SM, SC, SM-SC, SP-SM	A-2, A-4, A-6	0-5	80-100	65-95	55-85	10-45	10-35	NP-16
	34-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-100	30-70	0-10	---	NP
Leoni	0-13	Gravelly sandy loam.	SM	A-2, A-4	1-20	85-95	75-90	60-80	30-50	<30	NP-7
	13-29	Cobbly clay loam, gravelly sandy clay loam, gravelly sandy loam.	CL, SC, GC	A-6, A-4	10-50	70-85	60-85	50-70	40-60	25-40	8-20
	29-42	Gravelly sandy loam, cobbly sandy clay loam, gravelly clay loam.	SM, SC, SM-SC, SP-SM	A-2, A-1	10-50	70-85	60-85	40-50	10-25	<25	NP-8
	42-60	Cobbly sand, very gravelly loamy sand, very gravelly sandy loam.	SM, SP-SM, SC, SM-SC	A-1, A-2, A-4	5-60	65-85	40-80	35-50	5-40	<22	NP-8
13B*, 13C*, 13D*:											
Ormas	0-21	Loamy sand	SM	A-2-4	0	98-100	95-100	50-75	15-30	---	NP
	21-26	Sandy loam	SM-SC, SM	A-2-4, A-4	0	90-100	85-100	50-70	25-40	<15	NP-5
	26-45	Sandy clay loam, gravelly sandy loam, loamy sand.	SM-SC, SC, GC, GM-GC	A-4, A-6, A-2-4, A-2-6	0	60-80	55-80	35-70	20-45	20-40	6-20
	45-60	Gravelly sand	SP, SP-SM	A-3, A-1-B, A-2-4	0	60-80	55-80	30-55	3-12	---	NP
Spinks	0-18	Sand	SP-SM, SM	A-2-4, A-3	0	100	80-100	50-90	5-20	---	NP
	18-29	Sand	SM	A-2-4	0	100	80-100	50-90	15-25	---	NP
	29-68	Stratified fine sand to sand.	SM, SP-SM	A-2-4	0	100	80-100	60-90	10-30	---	NP
14B, 14C, 14D: Spinks	0-18	Sand	SP-SM, SM	A-2-4, A-3	0	100	80-100	50-90	5-20	---	NP
	18-29	Sand	SM	A-2-4	0	100	80-100	50-90	15-25	---	NP
	29-68	Stratified fine sand to sand.	SM, SP-SM	A-2-4	0	100	80-100	60-90	10-30	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
15A-----------------Teasdale	0-13	Fine sandy loam	SM, SM-SC, SC	A-2-4, A-4	0-5	95-100	95-100	55-95	25-50	<25	2-8
	13-55	Sandy loam, fine sandy loam, gravelly sandy clay loam.	ML, CL, SM, SC	A-2-4, A-2-6, A-4, A-6	0-8	85-100	80-100	50-85	25 70	20 35	2-15
	55-65	Sandy loam, loamy sand, fine sandy loam.	SM, SM SC, SC	A 2 4, A-4	0-5	85-100	85-100	55-70	15-40	25	NP-8
16A-----------------Brady	0-13	Sandy loam--------	SM, SM-SC	A-2, A-4	0-5	95-100	75-100	60-70	25-40	<25	NP-7
	13-30	Sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	95-100	75-95	60-80	25-45	15-35	NP-16
	30-54	Loamy sand, sandy loam.	SM	A-2	0-5	95-100	75-95	55-70	15 35	---	NP
	54-60	Stratified sand to gravel.	SP, SP-SM, GP, GP GM	A-1, A-3, A-2-4	0-5	40 75	35 70	20-55	0-10	---	NP
17--------------Barry	0 10	Loam --------------	ML, CL, CL-ML	A-4	0-3	95-100	90-100	80-100	55-90	20-30	NP-8
	10-26	Loam, sandy clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0-3	95-100	90-100	80-90	45-75	18-28	4-14
	26-60	Sandy loam, loamy sand.	SM, SM-SC	A-2, A-4	0-3	95-100	90-100	35-70	30-40	<20	NP 5
18*:											
Gilford------------	0-15	Fine sandy loam	SM, SC, SM SC	A-4	0	95-100	90-100	65-80	35-45	15-25	2-10
	15-35	Loam, fine sandy loam, loamy sand	SM, SC, SM-SC	A-2-4	0	90-100	90-100	55-70	25-35	20-30	NP-8
	35-60	Sandy loam, sand, loamy sand.	SM, SP, SP-SM	A-3, A-1-B,	0	90-100	85-100	18-60	3-18	---	NP
Colwood------------	0-16	Silt loam, very fine sandy loam.	ML	A-4, A-6	0	100	100	85-100	60-90	30 40	2-12
	16-33	Stratified loamy fine sand to clay loam.	CL, CL-ML	A-6, A-4	0	100	100	80-100	50-90	20-40	6-20
	33-60	Stratified silt loam to fine sand.	SM, ML	A-2, A-4	0	100	95-100	70-100	30-80	<35	NP-10
20-----------------Houghton	0-60	Sapric material	Pt	A-8	0	---	---	---	---	---	---
22-----------------Cohoctah	0-11	Fine sandy loam	ML, SM	A-4, A-2	0	100	100	65 95	30-75	<30	NP-6
	11-40	Loam, fine sandy loam, very fine sandy loam.	ML, SM, SC, CL	A-4, A-2	0	95 100	80 100	70-90	30-70	30	NP-10
	40-60	Silt loam, sand	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	65-90	20-70	<30	NP-10
29A----------------Kibbie	0-9	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	100	100	75-95	40-60	18-25	2-7
	9-27	Silt loam, clay loam, fine sandy loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-7	0	90-100	85-100	80-100	35 90	25 45	6-25
	27-60	Stratified silt loam to fine sand.	ML, SM, SC, CL	A-4, A 2	0	100	95-100	70-95	30-80	<30	NP-10
30 -----------Edwards	0-28	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	28-60	Marl--------------	---	---	0	100	95-100	80-90	60-80	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
35B*, 35C*, 35D*: Arkport--------	0-8	Loamy fine sand	SM	A-2, A-4	0	90-100	90-100	65-85	20-45	---	NP
	8-21	Very fine sandy loam, loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	90-100	90-100	70-95	30-65	<15	NP-4
	21-62	Fine sandy loam, loamy fine sand, loamy very fine sand.	SM, ML	A-2, A-4	0	90-100	90-100	65-95	20-60	---	NP
	62-66	Loamy fine sand, fine sand, very fine sand.	SM	A-2, A-4	0	90-100	90-100	60-95	15-50	---	NP
Okee------------	0-24	Loamy fine sand	SM, SP-SM	A-2, A-4, A-1-B	0	90-100	90-100	45-85	10-40	---	NP
	24-52	Sandy clay loam, sandy loam.	SC, SM, ML, CL	A-2, A-4	0-10	90-100	90-100	50-90	20-55	<25	2-10
	52-58	Sandy loam, loamy sand.	SM, SP-SM	A-2, A-4, A-1-B	0-10	85-100	85-100	40-75	10-40	<15	NP-3
	58-66	Gravelly sandy loam, sandy loam, loamy sand.	SM, SP-SM, GM, GP-GM	A-2, A-4, A-3, A-1-B	1-15	50-95	50-95	25-75	5-40	---	NP
37--------------- Palms	0-32	Sapric material	Pt	---	---	---	---	---	---	---	---
	32-60	Clay loam, sandy loam, loamy sand	ML, CL, SM, SC	A-4, A-6, A-2	0	85-100	80-100	70-95	25-90	15-40	NP-20
39A*: Ypsi------------	0-8	Sandy loam--------	SM, SM-SC	A-2, A-4	0-5	95-100	90-100	60-75	20-45	<25	NP-7
	8-29	Sandy loam, loamy sand, gravelly sandy loam.	SM, SC, SM-SC	A-2, A-4	0-5	95-100	80-100	60-75	20-40	15-30	2-10
	29-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-5	95-100	85-100	85-95	80-95	41-60	20-35
Wauseon----------	0-13	Loam--------------	ML	A-4	0	100	95-100	80-95	60-75	<35	NP-10
	13-36	Sandy loam, loamy fine sand, gravelly sandy loam.	SM	A-2, A-4	0	100	80-100	70-95	20-45	---	NP
	36-60	Clay, silty clay, silty clay loam.	CH, CL, MH, ML	A-7	0	100	95-100	90-100	80-95	42-70	18-36
40--------------- Lenawee	0-9	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	95-100	95-100	65-85	20-35	5-14
	9-38	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	95-100	90-100	80-95	25-55	11-30
	38-60	Silt loam, silty clay loam, very fine sand.	CL, CL-ML	A-6, A-4, A-7	0	100	95-100	95-100	85-95	25-45	6-22
42A, 42B, 42C, 42D------------- Riddles	0-13	Sandy loam--------	SM, SC, SM-SC	A-2-4, A-4	0	95-100	85-95	50-70	25-40	20-30	2-10
	13-19	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	19-44	Clay loam, sandy clay loam.	CL	A-6, A-7	0	90-100	80-95	75-95	65-75	35-50	15-30
	44-60	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15
43A-------------- Dixboro	0-17	Very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4	0	100	100	70-95	40-65	<20	2-6
	17-52	Very fine sandy loam, silt loam, sandy loam.	SM, ML, SC, CL	A-4	0	100	100	70-95	40-90	<25	2-10
	52-66	Stratified fine sand to silt loam.	SM, ML, SC, CL	A-2-4, A-4	0	100	95-100	70-95	20-80	<20	NP-8

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
44B, 44C, 44D----- Leoni	0-13	Gravelly sandy loam.	SM	A-2, A-4	1-20	85-95	75-90	60-80	30-50	<30	NP-7
	13-29	Cobbly clay loam, gravelly sandy clay loam, gravelly sandy loam.	CL, SC, GC	A-6, A-4	10-50	70-85	60-85	50-70	40-60	25-40	8-20
	29-42	Gravelly sandy loam, cobbly sandy clay loam, gravelly clay loam.	SM, SC, SM-SC, SP-SM	A-2, A-1	10-50	70-85	60-85	40-50	10-25	<25	NP-8
	42-60	Cobbly sand, very gravelly loamy sand, cobbly sandy loam.	SM, SP-SM, SC, SM-SC	A-1, A-2, A-4	5-60	65-85	40-80	35-50	5-40	<22	NP-8
45---------------- Martisco	0-8	Sapric material	Pt	---	0	---	---	---	---	---	---
	8-60	Marl-------------	---	---	0	---	---	---	---	---	---
46---------------- Sebewa	0-15	Loam--------------	CL, CL-ML	A-4, A-6	0	95-100	80-100	75-95	50-90	22-35	6-12
	15-35	Clay loam, loam, gravelly clay loam.	SC, CL	A-4, A-6	0	95-100	65-95	55-85	40-75	25-40	8-20
	35-60	Sand and gravel	SP, SP-SM, GP, GP-GM	A-1	0-5	40-75	35-70	20-40	0-10	---	NP
47*: Histosols.											
Aquents.											
48---------------- Napoleon	0-10	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	10-60	Hemic material----	Pt	A-8	0	---	---	---	---	---	---
49B*, 49C*, 49D*, 49E*: Hillsdale-------	0-10	Sandy loam--------	SM, SC, ML, CL	A-2-4, A-4	0-5	95-100	85-100	60-90	20-65	15-30	2-10
	10-15	Sandy loam--------	SM, SM-SC, SC	A-2-4, A-4	0-5	95-100	85-100	60-85	15-50	15-30	2-10
	15-63	Sandy loam, sandy clay loam, loam.	SM, SC, SM-SC	A-2-4, A-2-6, A-4, A-6	0-5	95-100	85-100	65-85	30-50	12-38	2-19
	63-66	Sandy loam, loamy sand.	SM, SC, SM-SC	A-2-4, A-4	0-5	95-100	85-100	55-80	25-40	15-22	3-8
Riddles---------	0-13	Sandy loam--------	SM, SC, SM-SC	A-2-4, A-4	0	95-100	85-95	50-70	25-40	20-30	2-10
	13-19	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	19-44	Clay loam, sandy clay loam.	CL	A-6, A-7	0	90-100	80-95	75-95	65-75	35-50	15-30
	44-60	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15
51*: Udorthents.											
Udipsamments.											
52*, 53*. Pits											
55B, 55C--------- Eleva	0-16	Sandy loam--------	SM, SM-SC	A-2, A-4	0	95-100	80-100	50-90	25-50	<20	2-7
	16-29	Loam, sandy loam, fine sandy loam.	ML, CL-ML, SM, SM-SC	A-2, A-4	0	95-100	80-100	50-95	25-65	<25	NP-7
	29-45	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
56D*:											
Riddles----------	0-13	Sandy loam--------	SM, SC, SM-SC	A-2-4, A-4	0	95-100	85-95	50-70	25-40	20-30	2-10
	13-19	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	19-44	Clay loam, sandy clay loam.	CL	A-6, A-7	0	90-100	80-95	75-95	65-75	35-50	15-30
	44-60	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15
Leoni------------	0-13	Gravelly sandy loam.	SM	A-2, A-4	1-20	85-95	75-90	60-80	30-50	<30	NP-7
	13-29	Cobbly clay loam, gravelly sandy clay loam, gravelly sandy loam.	CL, SC, GC	A-6, A-4	10-50	70-85	60-85	50-70	40-60	25-40	8-20
	29-42	Cobbly sandy loam, cobbly sandy clay loam, gravelly clay loam.	SM, SC, SM-SC, SP-SM	A-2, A-1	10-50	70-85	60-85	40-50	10-25	<25	NP-8
	42-60	Cobbly sand, very gravelly loamy sand, very gravelly sandy loam.	SM, SP-SM, SC, SM-SC	A-1, A-2, A-4	5-60	65-85	40-80	35-50	5-40	<22	NP-8
57A*. Urban land.											
Barry------------	0-10	Loam--------------	ML, CL, CL-ML	A-4	0-3	95-100	90-100	80-100	55-90	20-30	NP-8
	10-26	Loam, sandy clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0-3	95-100	90-100	80-90	45-75	18-28	4-14
	26-60	Sandy loam, loamy sand.	SM, SM-SC	A-2, A-4	0-3	95-100	90-100	35-70	30-40	<20	NP-5
Brady------------	0-13	Sandy loam--------	SM, SM-SC	A-2, A-4	0-5	95-100	75-100	60-70	25-40	<25	NP-7
	13-30	Sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	95-100	75-95	60-80	25-45	15-35	NP-16
	30-54	Loamy sand, sandy loam.	SM	A-2	0-5	95-100	75-95	55-70	15-35	---	NP
	54-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-5	40-75	35-70	20-55	0-10	---	NP
58B*, 58C*: Urban land.											
Oshtemo----------	0-17	Sandy loam--------	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	17-28	Gravelly sandy loam, gravelly sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	28-50	Sand--------------	SM, SP-SM	A-2	0	85-95	60-95	55-70	10-15	---	NP
	50-60	Stratified coarse sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
59B*, 59C*: Urban land.											
Riddles----------	0-13	Sandy loam--------	SM, SC, SM-SC	A-2-4, A-4	0	95-100	85-95	50-70	25-40	20-30	2-10
	13-19	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	19-44	Clay loam, sandy clay loam.	CL	A-6, A-7	0	90-100	80-95	75-95	65-75	35-50	15-30
	44-60	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
60*: Urban land.											
Udorthents.											
61B------------- Saylesville	0-10	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	85-100	60-90	20-30	3-10
	10-22	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	95-100	95-100	85-100	40-65	25-40
	22-60	Stratified silty clay loam to very fine sandy loam.	CL	A-6, A-7	0	100	100	95-100	95-100	30-45	10-25
62A------------- Del Rey	0-9	Silt loam--------	CL, ML, CL-ML	A-6, A-4, A-7	0	95-100	95-100	90-98	75-95	25-50	5-20
	9-24	Silty clay loam, silty clay.	CH, CL	A-7, A-6	0	95-100	95-100	90-100	70-95	35-55	15-30
	24-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	30-50	10-25
63-------------- Henrietta	0-12	Sapric material	Pt	A-8	---	---	---	---	---	---	---
	12-43	Stratified loamy fine sand to silt loam.	CL, ML, SM, SC	A-2-4, A-4	0	95-100	85-100	50-100	25-85	<25	2-10
	43-60	Stratified loamy fine sand to silt loam.	CL, ML, SM, SC	A-2-4, A-4	0	95-100	85-100	50-100	25-85	<25	2-10
64B*, 64C*: Marlette--------	0-8	Loam-------------	CL, ML, CL-ML	A-4	0-5	95-100	85-95	80-95	60-70	20-30	3-10
	8-32	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	80-100	55-90	20-40	5-25
	32-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25
Owosso----------	0-12	Sandy loam-------	SM, SM-SC, SC	A-2, A-4	0-5	95-100	75-100	50-70	20-45	12-29	NP-10
	12-32	Sandy loam, sandy clay loam, clay loam.	SM, SC, ML, CL	A-2, A-4	0-5	95-100	75-100	60-90	25-60	15-30	NP-10
	32-60	Loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-95	85-95	60-90	25-40	6-21
65A------------- Capac	0-14	Loam-------------	CL, ML, CL-ML	A-4	0-5	95-100	90-100	80-95	60-75	<25	3-10
	14-34	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	85-100	50-80	25-40	5-20
	34-60	Loam-------------	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	80-95	60-75	15-35	5-15
66E------------- Eleva Variant	0-6	Channery fine sandy loam.	SM, SM-SC, SC	A-2-4, A-1-B	0-20	70-90	60-80	35-55	20-30	<20	NP-10
	6-24	Very channery sandy loam.	SM, SC, SM-SC, SP-SM	A-2-4, A-2-6, A-1-B	5-20	65-85	55-75	30-50	12-30	<25	NP-10
	24-28	Weathered bedrock	---	---		---	---	---	---	---	---
67B------------- Whalan	0-11	Loam-------------	ML	A-4	0	100	95-100	85-95	60-90	30-40	5-10
	11-21	Clay loam, loam	CL	A-6	0	95-100	95-100	80-95	70-90	30-40	10-15
	21-30	Clay loam, clay, silty clay loam.	CL, CH	A-7	0-5	80-100	70-95	65-90	50-85	40-60	20-35
	30	Weathered bedrock	---	---	---	---	---	---	---	---	

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
68B*, 68C*:											
Oshtemo----------	0-17	Sandy loam--------	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	17-28	Gravelly sandy loam, gravelly sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	28-50	Loamy sand--------	SM, SP-SM	A-2	0	85-95	60-95	55-70	10-15	---	NP
	50-60	Stratified coarse sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
Leoni------------	0-13	Gravelly sandy loam.	SM	A-2, A-4	1-20	85-95	75-90	60-80	30-50	<30	NP-7
	13-29	Cobbly clay loam, gravelly sandy clay loam, gravelly sandy loam.	CL, SC, GC	A-6, A-4	10-50	70-85	60-85	50-70	40-60	25-40	8-20
	29-42	Cobbly sandy loam, cobbly sandy clay loam, gravelly clay loam.	SM, SC, SM-SC, SP-SM	A-2, A-1	10-50	70-85	60-85	40-50	10-25	<25	NP-8
	42-60	Cobbly sand, cherty loamy sand, very gravelly sandy loam.	SM, SP-SM, SC, SM-SC	A-1, A-2, A-4	5-60	65-85	40-80	35-50	5-40	<22	NP-8

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
11B*, 11C*, 11D*:											
Boyer----------	0-11	5-15	1.14-1.60	2.0-6.0	0.10-0.15	5.6-7.3	Low-----------	0.24	4	3	.5-3
	11-34	10-18	1.26-1.59	2.0-6.0	0.12-0.18	5.6-7.8	Low-----------	0.24			
	34-60	0-10	1.20-1.47	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
Oshtemo----------	0-17	2-10	1.14-1.60	2.0-6.0	0.10-0.15	5.1-6.5	Low-----------	0.24	5	3	.5-3
	17-28	10-22	1.20-1.59	2.0-6.0	0.12-0.19	5.1-6.5	Low-----------	0.24			
	28-60	0-15	1.20-1.47	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
11E*:											
Boyer----------	0-11	5-15	1.14-1.60	2.0-6.0	0.10-0.15	5.6-7.3	Low-----------	0.24	4	3	.5-3
	11-34	10-18	1.26-1.59	2.0-6.0	0.12-0.18	5.6-7.8	Low-----------	0.24			
	34-60	0-10	1.20-1.47	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
Leoni------------	0-13	2-18	1.30-1.70	0.6-6.0	0.07-0.15	5.6-7.3	Low-----------	0.10	3	8	1-3
	13-29	18-35	1.30-1.70	0.6-2.0	0.06-0.12	5.1-7.3	Moderate------	0.10			
	29-42	18-35	1.30-1.70	2.0-6.0	0.03-0.09	5.6-7.8	Low-----------	0.10			
	42-60	0-18	1.20-1.50	2.0-20	0.01-0.03	7.4-8.4	Low-----------	0.10			
13B*, 13C*, 13D*:											
Ormas	0-21	5-12	1.40-1.60	2.0-6.0	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	1-3
	21-26	10-20	1.50-1.70	2.0-6.0	0.12-0.14	5.1-6.5	Low-----------	0.17			
	26-45	18-25	1.50-1.60	2.0-6.0	0.11-0.14	5.6-7.8	Low-----------	0.32			
	45-60	1-8	1.55-1.70	>20	0.03-0.05	7.4-8.4	Low-----------	0.15			
Spinks-----------	0-18	0-10	1.14-1.60	6.0-20	0.06-0.08	5.1-7.3	Low-----------	0.17	5	1	2-4
	18-29	3-15	1.26-1.59	6.0-20	0.08-0.10	5.6-7.3	Low-----------	0.17			
	29-68	0-15	1.20-1.47	2.0-20	0.04-0.08	5.6-7.8	Low-----------	0.17			
14B, 14C, 14D Spinks	0-18	0-10	1.14-1.60	6.0-20	0.06-0.08	5.1-7.3	Low-----------	0.17	5	1	2-4
	18-29	3-15	1.26-1.59	6.0-20	0.08-0.10	5.6-7.3	Low-----------	0.17			
	29-68	0-15	1.20-1.47	2.0-20	0.04-0.08	5.6-7.8	Low-----------	0.17			
15A--------------- Teasdale	0-13	5-15	1.25-1.75	2.0-6.0	0.12-0.15	5.1-6.5	Low-----------	0.24	5	3	2-3
	13-55	10-18	1.40-1.85	0.6-2.0	0.11-0.17	4.5-7.3	Low-----------	0.24			
	55-65	5-15	1.70-1.95	2.0-6.0	0.08-0.15	6.6-8.4	Low-----------	0.24			
16A--------------- Brady	0-13	2-15	1.25-1.41	2.0-6.0	0.12-0.15	5.6-7.3	Low-----------	0.20	5	3	1-4
	13-30	5-22	1.35-1.45	2.0-6.0	0.12-0.17	5.1-6.5	Low-----------	0.20			
	30-54	5-20	1.25-1.50	2.0-20	0.08-0.10	5.1-6.5	Low-----------	0.20			
	54-60	0-10	1.25-1.50	>20	0.02-0.04	6.6-8.4	Low-----------	0.10			
17--------------- Barry	0-10	8-18	1.60-1.75	0.6-2.0	0.20-0.22	6.1-7.8	Low-----------	0.28	5	5	4-7
	10-26	18-25	1.25-1.85	0.6-2.0	0.14-0.19	6.1-7.8	Low-----------	0.28			
	26-60	5-18	1.80-2.00	2.0-6.0	0.10-0.13	7.4-8.4	Low-----------	0.28			
18*:											
Gilford----------	0-15	10-20	1.50-1.70	2.0-6.0	0.13-0.15	5.6-6.5	Low-----------	0.20	4	3	2-4
	15-35	8-17	1.60-1.80	2.0-6.0	0.10-0.14	5.6-7.3	Low-----------	0.20			
	35-60	3-12	1.70-1.90	6.0-20	0.05-0.08	6.6-8.4	Low-----------	0.15			
Colwood----------	0-16	5-26	1.14-1.60	0.6-2.0	0.20-0.24	6.1-7.8	Low-----------	0.28	5	5	1-4
	16-33	18-35	1.26-1.59	0.6-2.0	0.17-0.22	6.1-8.4	Moderate------	0.43			
	33-60	0-12	1.20-1.47	0.6-2.0	0.12-0.22	7.4-8.4	Low-----------	0.43			
20--------------- Houghton	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	--------------	----		3	>70
22--------------- Cohoctah	0-11	5-20	1.12-1.59	2.0-6.0	0.13-0.22	6.1-7.8	Low-----------	0.28	5	3	1-4
	11-40	5-27	1.48-1.80	2.0-6.0	0.12-0.20	6.1-8.4	Low-----------	0.28			
	40-60	2-25	1.46-1.95	2.0-6.0	0.08-0.20	6.1-8.4	Low-----------	0.28			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
29A--------------- Kibbie	0-9	2-20	1.43-1.73	0.6-2.0	0.16-0.20	5.6-7.3	Low-----------	0.20	5	3	1-3
	9-27	5-35	1.44-1.81	0.6-2.0	0.17-0.22	5.6-7.3	Low-----------	0.43			
	27-60	2-18	1.47-1.90	0.6-2.0	0.12-0.22	7.4-8.4	Low-----------	0.43			
30--------------- Edwards	0-28	---	0.30-0.55	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	---	3	55-75
	28-60	---	---	---	---	7.4-8.4	-------------	----			
35B*, 35C*, 35D*:											
Arkport---------	0-8	5-18	1.10-1.40	2.0-6.0	0.08-0.09	4.5-7.3	Low-----------	0.17	3	2	2-6
	8-21	3-15	1.25-1.55	2.0-6.0	0.06-0.16	4.5-7.3	Low-----------	0.43			
	21-62	1-5	1.25-1.55	2.0-6.0	0.06-0.12	5.1-7.3	Low-----------	0.43			
	62-66	1-5	1.25-1.55	2.0-6.0	0.02-0.06	5.6-7.8	Low-----------	0.43			
Okee------------	0-24	4-10	1.55-1.70	2.0-6.0	0.12-0.14	6.1-7.3	Low-----------	0.17	4	2	.5-2
	24-52	10-18	1.55-1.70	0.6-2.0	0.12-0.16	5.6-7.8	Low-----------	0.28			
	52-58	4-15	1.55-1.65	0.6-6.0	0.09-0.11	5.6-7.8	Low-----------	0.28			
	58-66	4-15	1.35-1.85	0.6-6.0	0.07-0.12	7.4-8.4	Low-----------	0.28			
37--------------- Palms	0-32	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-8.4	-------------	----	---	3	>75
	32-60	7-35	1.46-2.00	0.2-2.0	0.14-0.22	6.1-8.4	Low-----------	----			
39A*:											
Ypsi------------	0-8	5-18	1.29-1.72	2.0-6.0	0.12-0.16	6.1-7.3	Low-----------	0.20	4	3	1-3
	8-29	5-20	1.40-1.83	2.0-6.0	0.10-0.14	6.1-7.3	Low-----------	0.20			
	29-60	40-60	1.43-1.81	0.06-0.2	0.06-0.10	7.4-8.4	High----------	0.32			
Wauseon----------	0-13	7-20	1.20-1.60	2.0-6.0	0.20-0.22	6.1-7.3	Low-----------	0.28	4	4	4-8
	13-36	5-18	1.30-1.70	6.0-20	0.06-0.16	6.6-7.8	Low-----------	0.20			
	36-60	27-55	1.50-1.90	<0.06	0.08-0.18	7.4-8.4	High----------	0.32			
40--------------- Lenawee	0-9	10-27	0.91-1.55	0.6-2.0	0.20-0.24	5.6-6.0	Low-----------	0.28	4	6	2-5
	9-38	35-45	1.39-1.78	0.2-0.6	0.18-0.20	6.6-7.8	Moderate------	0.28			
	38-60	18-40	1.51-1.80	0.6-2.0	0.18-0.22	7.4-7.8	Low-----------	0.28			
42A, 42B, 42C, 42D------------ Riddles	0-13	4-14	1.35-1.55	2.0-6.0	0.13-0.15	6.1-7.3	Low-----------	0.24	5	3	.5-2
	13-19	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Moderate---	0.32			
	19-44	20-35	1.40-1.60	0.6-2.0	0.15-0.19	5.1-7.3	Moderate-----	0.32			
	44-60	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	Low-----------	0.32			
43A-------------- Dixboro	0-17	2-15	1.30-1.70	2.0-6.0	0.16-0.22	5.6-7.3	Low-----------	0.20	5	3	2-3
	17-52	6-17	1.40-1.80	0.6-2.0	0.10-0.20	5.6-7.8	Low-----------	0.20			
	52-66	0-15	1.50-1.70	0.6-2.0	0.07-0.20	7.4-8.4	Low-----------	0.20			
44B, 44C, 44D---- Leoni	0-13	2-18	1.30-1.70	0.6-6.0	0.07-0.15	5.6-7.3	Low-----------	0.10	3	8	1-3
	13-29	18-35	1.30-1.70	0.6-2.0	0.06-0.12	5.1-7.3	Moderate-----	0.10			
	29-42	18-35	1.30-1.70	2.0-6.0	0.03-0.09	5.6-7.8	Low-----------	0.10			
	42-60	0-18	1.20-1.50	2.0-20	0.01-0.03	7.4-8.4	Low-----------	0.10			
45--------------- Martisco	0-8			0.6-6.0	0.25-0.35	6.1-8.4	Low-----------	----	---	---	---
	8-60	---	---	0.06-0.2	---	7.9-8.4	Low-----------	----			
46--------------- Sebewa	0-15	10-25	1.15-1.60	0.6-2.0	0.18-0.22	6.1-7.8	Low-----------	0.24	4	5	1-4
	15-35	18-35	1.50-1.80	0.6-2.0	0.15-0.19	6.1-7.8	Low-----------	0.24			
	35-60	0-3	1.55-1.75	6.0-20	0.02-0.04	7.4-8.4	Low-----------	0.10			
47*. Histosols.											
Aquents.											
48--------------- Napoleon	0-10	---	0.30-0.40	0.2-6.0	0.35-0.45	<4.5	-------------	----	---	2	---
	10-60	---	0.10-0.20	0.6-6.0	0.45-0.55	<4.5	-------------	----			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
49B*, 49C*, 49D*, 49E*:											
Hillsdale	0-10	2-15	1.10-1.64	0.6-6.0	0.13-0.22	5.1-7.3	Low	0.24	5	3	1-3
	10-15	5-15	1.22-1.87	2.0-6.0	0.13-0.15	4.5-6.5	Low	0.24			
	15-63	10-22	1.22-1.87	0.6-6.0	0.12-0.18	4.5-6.5	Low	0.24			
	63-66	0-15	1.31-1.99	2.0-6.0	0.11-0.13	7.9-8.4	Low	0.24			
Riddles	0-13	4-14	1.35-1.55	2.0-6.0	0.13-0.15	6.1-7.3	Low	0.24	5	3	.5-2
	13-19	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Moderate	0.32			
	19-44	20-35	1.40-1.60	0.6-2.0	0.15-0.19	5.1-7.3	Moderate	0.32			
	44-60	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	Low	0.32			
51*. Udorthents.											
Udipsamments.											
52*, 53*. Pits											
55B, 55C: Eleva	0-16	5-15	1.40-1.70	2.0-6.0	0.13-0.18	5.1-7.3	Low	0.24	4	3	1-3
	16-29	10-18	1.50-1.70	0.6-6.0	0.12-0.19	5.1-6.5	Low	0.24			
	29-45	---	---	-	---	---	------------	----			
56D*:											
Riddles	0-13	4-14	1.35-1.55	2.0-6.0	0.13-0.15	6.1-7.3	Low	0.24	5	3	.5-2
	13-19	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Moderate	0.32			
	19-44	20-35	1.40-1.60	0.6-2.0	0.15-0.19	5.1-7.3	Moderate	0.32			
	44-60	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	Low	0.32			
Leoni	0-13	2-18	1.30-1.70	0.6-6.0	0.07-0.15	5.6-7.3	Low	0.10	3	8	1-3
	13-29	18-35	1.30-1.70	0.6-2.0	0.06-0.12	5.1-7.3	Moderate	0.10			
	29-42	18-35	1.30-1.70	2.0-6.0	0.03-0.09	5.6-7.8	Low	0.10			
	42-60	0-18	1.20-1.50	2.0-20	0.01-0.03	7.4-8.4	Low	0.10			
57A*: Urban land.											
Barry	0-10	8-18	1.60-1.75	0.6-2.0	0.20-0.22	6.1-7.8	Low	0.28	5	5	4-7
	10-26	18-25	1.25-1.85	0.6-2.0	0.14-0.19	6.1-7.8	Low	0.28			
	26-60	5-18	1.80-2.00	2.0-6.0	0.10-0.13	7.4-8.4	Low	0.28			
Brady	0-13	2-15	1.25-1.41	2.0-6.0	0.12-0.15	5.6-7.3	Low	0.20	5	3	1-4
	13-30	5-22	1.35-1.45	2.0-6.0	0.12-0.17	5.1-6.5	Low	0.20			
	30-54	5-20	1.25-1.50	2.0-20	0.08-0.10	5.1-6.5	Low	0.20			
	54-60	0-10	1.25-1.50	>20	0.02-0.04	6.6-8.4	Low	0.10			
58B*, 58C*: Urban land.											
Oshtemo	0-17	2-10	1.14-1.60	2.0-6.0	0.10-0.15	5.1-6.5	Low	0.24	5	3	.5-3
	17-28	10-22	1.20-1.59	2.0-6.0	0.12-0.19	5.1-6.5	Low	0.24			
	28-50	5-15	1.20-1.59	6.0-20	0.06-0.08	5.1-7.3	Low	0.17			
	50-60	0-15	1.20-1.47	>20	0.02-0.04	7.4-8.4	Low	0.10			
59B*, 59C*: Urban land.											
Riddles	0-13	4-14	1.35-1.55	2.0-6.0	0.13-0.15	6.1-7.3	Low	0.24	5	3	.5-2
	13-19	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Moderate	0.32			
	19-44	20-35	1.40-1.60	0.6-2.0	0.15-0.19	5.1-7.3	Moderate	0.32			
	44-60	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	Low	0.32			
60*: Urban land.											

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
60*: Udorthents.											
61B----------------- Saylesville	0-10	12-25	1.35-1.55	0.6-2.0	0.20-0.24	5.6-7.8	Low------------	0.37	3	5	1-3
	10-22	35-45	1.60-1.70	0.2-0.6	0.09-0.13	6.6-7.8	Moderate------	0.37			
	22-60	25-35	1.60-1.75	0.2-0.6	0.18-0.20	7.4-8.4	Moderate------	0.37			
62A----------------- Del Rey	0-9	20-30	1.30-1.50	0.6-2.0	0.22-0.24	5.1-6.5	Low------------	0.43	3	6	2-3
	9-24	35-45	1.35-1.55	0.06-0.2	0.12-0.20	6.1-8.4	Moderate------	0.43			
	24-60	25-35	1.45-1.65	0.06-0.2	0.09-0.11	7.9-8.4	Moderate------	0.43			
63------------------ Henrietta	0-12	---	0.22-0.52	0.2-6.0	0.35-0.45	5.6-7.8	---------------	----	---	3	42-64
	12-43	5-18	1.48-1.80	0.6-2.0	0.09-0.22	5.6-7.8	Low------------	0.28			
	43-60	5-18	1.46-1.95	0.6-2.0	0.08-0.22	7.9-8.4	Low------------	0.28			
64B*, 64C*: Marlette----------	0-8	10-18	1.31-1.78	2.0-6.0	0.18-0.22	5.6-7.3	Low------------	0.32	5	5	1-3
	8-32	18-30	1.31-1.86	0.2-2.0	0.18-0.20	5.6-7.8	Low------------	0.32			
	32-60	15-25	1.33-1.89	0.2-2.0	0.12-0.19	7.9-8.4	Low------------	0.32			
Owosso------------	0-12	5-18	1.10-1.65	2.0-6.0	0.13-0.18	5.1-7.3	Low------------	0.24	5	3	1-2
	12-32	10-22	1.10-1.65	2.0-6.0	0.09-0.17	5.1-7.3	Low------------	0.24			
	32-60	18-35	1.30-1.75	0.2-0.6	0.14-0.20	5.1-8.4	Moderate------	0.37			
65A----------------- Capac	0-14	10-18	1.43-1.73	0.6-2.0	0.18-0.20	5.6-7.3	Low------------	0.32	5	5	1-3
	14-34	18-35	1.44-1.81	0.2-2.0	0.14-0.18	5.6-7.3	Low------------	0.32			
	34-60	10-25	1.47-1.90	0.2-2.0	0.14-0.16	7.4-8.4	Low------------	0.32			
66E----------------- Eleva Variant	0-6	3-15	1.10-1.64	2.0-6.0	0.06-0.12	5.1-7.3	Low------------	0.17	3	8	1-3
	6-24	10-18	1.22-1.59	2.0-6.0	0.06-0.09	5.1-6.5	Low------------	0.17			
	24-28	---	---	---	---	---	---------------				
67B----------------- Whalan	0-11	18-25	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low------------	0.32	4	6	1-2
	11-21	18-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Low------------	0.32			
	21-30	35-60	1.35-1.45	0.06-0.6	0.15-0.19	5.6-7.8	High-----------	0.32			
	30	---	---	---	---	---	---------------	----			
68B*, 68C*: Oshtemo-----------	0-17	2-10	1.14-1.60	2.0-6.0	0.10-0.15	5.1-6.5	Low------------	0.24	5	3	.5-3
	17-28	10-22	1.20-1.59	2.0-6.0	0.12-0.19	5.1-6.5	Low------------	0.24			
	28-50	5-15	1.20-1.59	6.0-20	0.06-0.08	5.1-7.3	Low------------	0.17			
	50-60	0-15	1.20-1.47	>20	0.02-0.04	7.4-8.4	Low------------	0.10			
Leoni--------------	0-13	2-18	1.30-1.70	0.6-6.0	0.07-0.15	5.6-7.3	Low------------	0.10	3	8	1-3
	13-29	18-35	1.30-1.70	0.6-2.0	0.06-0.12	5.1-7.3	Moderate------	0.10			
	29-42	18-35	1.30-1.70	2.0-6.0	0.03-0.09	5.6-7.8	Low------------	0.10			
	42-60	0-18	1.20-1.50	2.0-20	0.01-0.03	7.4-8.4	Low------------	0.10			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Total		Uncoated steel	Concrete
					Ft			In			
11B*, 11C*, 11D*: Boyer	B	None	---	---	>6.0	---	---	---	Low	Low	Moderate.
Oshtemo	B	None	---	---	>6.0	---	---	---	Low	Low	High.
11E*: Boyer	B	None	---	---	>6.0	---	---	---	Low	Low	Moderate.
Leoni	B	None	---	---	>6.0	---	---	---	Low	Low	Moderate.
13B*, 13C*, 13D*: Ormas	B	None	---	---	>6.0	---	---	---	Moderate	Low	Moderate.
Spinks	A	None	---	---	>6.0	---	---	---	Low	Low	Low.
14B, 14C, 14D: Spinks	A	None	---	---	>6.0	---	---	---	Low	Low	Low.
15A: Teasdale	B	None	---	---	0.5-1.5	Apparent	Nov-May	---	High	Moderate	Moderate.
16A: Brady	B	None	---	---	1.0-3.0	Apparent	Nov-May	---	High	Low	Moderate.
17: Barry	B/D	None	---	---	+1-1.0	Apparent	Nov-May	---	High	High	Low.
18*: Gilford	B	None	---	---	+.5-1.0	Apparent	Sep-Jun	---	High	High	Moderate.
Colwood	B/D	None	---	---	+1-1.5	Apparent	Oct-May	---	High	High	Low.
20: Houghton	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	55-60	High	High	Low.
22: Cohoctah	B/D	Frequent	Brief	Jan-Dec	0-1.0	Apparent	Sep-May	---	High	High	Low.
29A: Kibbie	B	None	---	---	1.0-2.0	Apparent	Nov-May		High	Low	High.
30: Edwards	B/D	None	---	---	+1-0.5	Apparent	Sep-Jun	25-30	High	High	Low.
35B*, 35C*, 35D*: Arkport	B	None	---	---	>6.0	---	---	---	Low	Low	Moderate.
Okee	A	None	---	---	>6.0	---	---	---	Low	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Total		Uncoated steel	Concrete
					Ft			In			
37 Palms	A/D	None	---	---	+1-1.0	Apparent	Nov-May	25-32	High	High	Moderate.
39A*: Ypsi	C	None	---	---	1.0-2.0	Perched	Nov-May	---	High	High	Moderate.
Wasson	B/D	None	---	---	+1-1.0	Perched	Jan-Apr	---	High	High	Low.
40 Lenawee	B/D	None	---	---	+1-1.0	Apparent	Nov-May	---	High	High	Low.
42A, 42B, 42C, 42D Riddles	B	None	---	---	>6.0	---	---	---	Moderate	Moderate	Moderate.
43A Dixboro	B	None	---	---	1.0-2.0	Apparent	Nov-Apr	---	High	Moderate	Moderate.
44B, 44C, 44D Leoni	B	None	---	---	>6.0	---	---	---	Low	Low	Moderate.
45 Martisco	D	None	---	---	+1-1.0	Apparent	Oct-Jun	---	High	High	Low.
46 Sebewa	B/D	None	---	---	+1-1.0	Apparent	Sep-May	---	High	High	Low.
47*. Histosols.											
Aquents.											
48 Napoleon	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	50-59	High	Moderate	High.
49B*, 49C*, 49D*, 49E*: Hillsdale	B	None	---	---	>6.0	---	---	---	Moderate	Low	High.
Riddles	B	None	---	---	>6.0	---	---	---	Moderate	Moderate	Moderate.
51*: Udorthents.											
Udipsamments.											
52*, 53*. Pits											
55B, 55C Eleva	B	None	---	---	>6.0	---	---	---	Moderate	Low	Moderate.

See footnote at end of table.

TABLE 17. SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Subsidence: Total	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In			
56D*:											
Riddles	B	None	---	---	>6.0	---	---	---	Moderate	Moderate	Moderate.
Leoni	B	None	---	---	>6.0	---	---	---	Low	Low	Moderate.
57A*:											
Urban land.											
Barry	B/D	None	---	---	+1-1.0	Apparent	Nov-May	---	High	High	Low.
Brady	B	None	---	---	1.0-3.0	Apparent	Nov-May	---	High	Low	Moderate.
58B*, 58C*:											
Urban land.											
Oshtemo	B	None	---	---	>6.0	---	---	---	Low	Low	High.
59B*, 59C*:											
Urban land.											
Riddles	B	None	---	---	>6.0	---	---	---	Moderate	Moderate	Moderate.
60*:											
Urban land.											
Udorthents.											
61B Saylesville	C	None	---	---	>6.0	---	---	---	Moderate	High	Moderate.
62A Del Rey	C	None	---	---	1.0-3.0	Apparent	Jan-May	---	High	High	Low.
63 Henrietta	D	None	---	---	+1-1.0	Apparent	Nov-Jun	---	High	High	Low.
64B*, 64C*:											
Marlette	B	None	---	---	>6.0	---	---	---	Moderate	Low	Moderate.
Owosso	B	None	---	---	>6.0	---	---	---	Moderate	Moderate	Moderate.
65A Capac	B	None	---	---	1.0-2.0	Apparent	Nov-May	---	High	High	Low.
66B Eleva Variant	B	None	---	---	>6.0	---	---	---	Moderate	Low	Moderate.
67B Whalan	B	None	---	---	>6.0	---	---	---	Moderate	Moderate	Low.
68B*, 68C*:											
Oshtemo	B	None	---	---	>6.0	---	---	---	Low	Low	High.
Leoni	B	None	---	---	>6.0	---	---	---	Low	Low	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Aquents	Mixed, nonacid, mesic Aquents
Arkport	Coarse-loamy, mixed, mesic Psammentic Hapludalfs
Barry	Fine-loamy, mixed, mesic Typic Argiaquolls
Boyer	Coarse-loamy, mixed, mesic Typic Hapludalfs
Brady*	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Capac	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
Colwood	Fine-loamy, mixed, mesic Typic Haplaquolls
Del Rey	Fine, illitic, mesic Aeric Ochraqualfs
Dixboro*	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Edwards	Marly, euic, mesic Limnic Medisaprists
Eleva	Coarse-loamy, mixed, mesic Typic Hapludalfs
Eleva Variant	Loamy-skeletal, mixed, mesic Typic Hapludalfs
Gilford	Coarse loamy, mixed, mesic Typic Haplaquolls
Henrietta	Coarse-loamy, mixed, mesic Histic Humaquepts
Hillsdale	Coarse-loamy, mixed, mesic Typic Hapludalfs
Histosols	Euic, mesic Histosols
Houghton	Euic, mesic Typic Medisaprists
Kibbie*	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Lenawee	Fine, mixed, nonacid, mesic Mollic Haplaquepts
Leoni	Loamy-skeletal, mixed, mesic Typic Hapludalfs
Marlette	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
Martisco	Fine-silty, carbonatic, mesic Histic Humaquepts
Napoleon	Dysic, mesic Typic Medihemists
Okee	Loamy, mixed, mesic Arenic Hapludalfs
Ormas	Loamy, mixed, mesic Arenic Hapludalfs
Oshtemo	Coarse loamy, mixed, mesic Typic Hapludalfs
Owosso	Fine-loamy, mixed, mesic Typic Hapludalfs
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Riddles	Fine-loamy, mixed, mesic Typic Hapludalfs
Saylesville	Fine, illitic, mesic Typic Hapludalfs
Sebewa	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiaquolls
Spinks	Sandy, mixed, mesic Psammentic Hapludalfs
Teasdale	Coarse-loamy, siliceous, mesic Glossaquic Hapludalfs
Udipsamments	Mixed, mesic Udipsamments
Udorthents	Loamy, mixed, mesic Udorthents
Wauseon*	Coarse-loamy over clayey, mixed, mesic Typic Haplaquolls
Whalan	Fine loamy, mixed, mesic Typic Hapludalfs
Ypsi	Coarse loamy over clayey, mixed, mesic Udollic Ochraqualfs

*The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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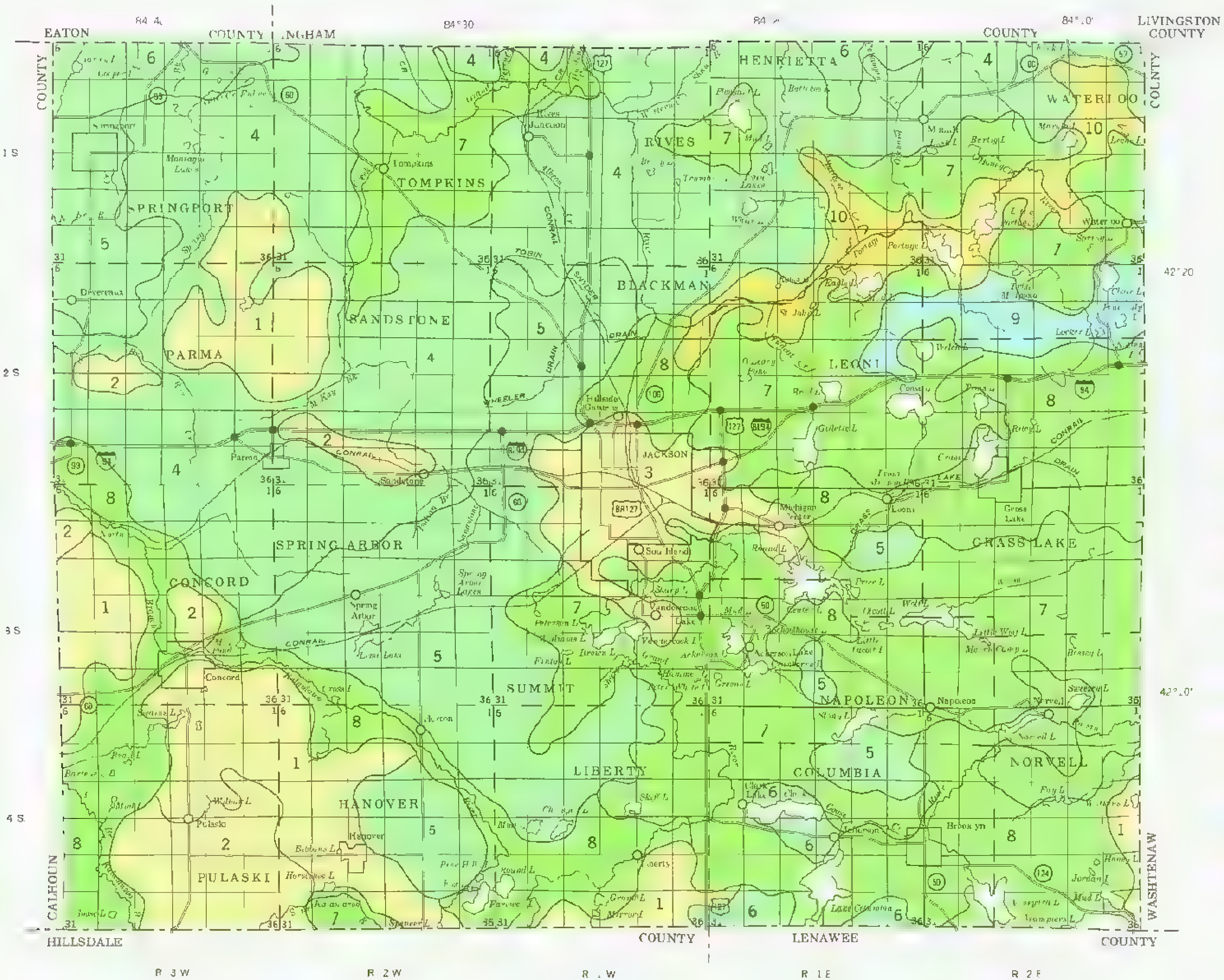


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MICHIGAN AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
JACKSON COUNTY, MICHIGAN

Scale 1:190,080

1 0 1 2 3 4 Miles

1 0 1 2 3 4 5 6 Kilometers

SOIL LEGEND*

DOMINANTLY NEARLY LEVEL TO ROLLING, DEEP AND MODERATELY DEEP SOILS THAT ARE WELL DRAINED AND SOMEWHAT EXCESSIVELY DRAINED

1 — Hillsdale-Riddles association: Deep, well drained, loamy soils that formed in glacial till

2 — Hillsdale-Eleva-Riddles association: Deep and moderately deep, well drained and somewhat excessively drained, loamy soils that formed in glacial till, in material that weathered from sandstone, or in glacial drift over sandstone

3 — Urban land-Oshtemo association: Urban land and deep, well drained, loamy soils that formed in glaciofluvial deposits

DOMINANTLY NEARLY LEVEL TO ROLLING, DEEP SOILS THAT ARE WELL DRAINED, SOMEWHAT POORLY DRAINED, AND VERY POORLY DRAINED

4 — Hillsdale-Riddles-Teasdale association: Deep, well drained and somewhat poorly drained, loamy soils that formed in glacial till

5 — Riddles-Teasdale-Palms association: Deep, well drained, somewhat poorly drained, and very poorly drained, loamy and mucky soils that formed in glacial till or in organic material and the underlying loamy glaciofluvial deposits

6 — Marlette-Capac-Houghton association: Deep, well drained, somewhat poorly drained, and very poorly drained, loamy and mucky soils that formed in glacial till or in organic material

DOMINANTLY NEARLY LEVEL TO ROLLING, DEEP SOILS THAT ARE WELL DRAINED AND VERY POORLY DRAINED

7 — Spinks-Ormas-Houghton association: Deep, well drained and very poorly drained, sandy and mucky soils that formed in glaciofluvial deposits or in organic material

8 — Boyer-Oshtemo-Houghton association: Deep, well drained and very poorly drained, loamy and mucky soils that formed in glaciofluvial deposits or in organic material

DOMINANTLY ROLLING TO VERY STEEP AND NEARLY LEVEL, DEEP SOILS THAT ARE WELL DRAINED AND VERY POORLY DRAINED

9 — Boyer-Hillsdale-Houghton association: Deep, well drained and very poorly drained, loamy and mucky soils that formed in glaciofluvial deposits, glacial till, or organic material

DOMINANTLY NEARLY LEVEL, DEEP SOILS THAT ARE VERY POORLY DRAINED

10 — Houghton-Palms-Henrietta association: Deep, very poorly drained, mucky soils that formed in organic material or in organic material and the underlying loamy and sandy glaciofluvial deposits

*Texture refers to the surface layer of the major soils

Compiled 1979

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

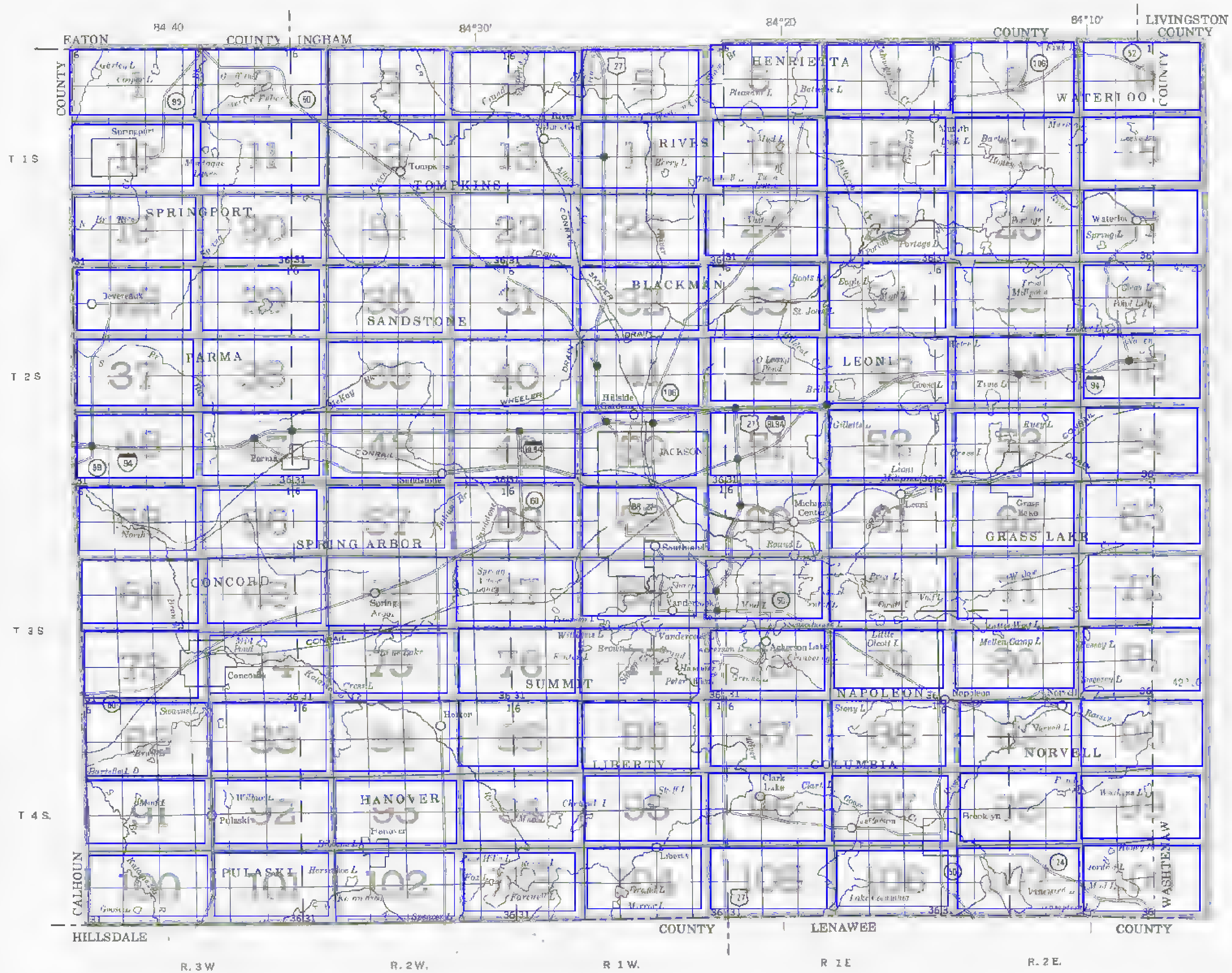
INDEX TO MAP SHEETS

JACKSON COUNTY, MICHIGAN

Scale 1:80 000

0 1 2 3 4 Miles

1 0 1 2 3 4 5 6 Kilometers



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and letters. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
11B	Boyer–Oshtemo sandy loams, 1 to 6 percent slopes
11C	Boyer–Oshtemo sandy loams, 6 to 12 percent slopes
11D	Boyer–Oshtemo sandy loams, 12 to 18 percent slopes
12E	Boyer–Leoni complex, 18 to 40 percent slopes
13B	Ormas–Spinks complex, 0 to 6 percent slopes
13C	Ormas–Spinks complex, 6 to 12 percent slopes
13D	Ormas–Spinks complex, 12 to 25 percent slopes
14B	Spinks sand, 0 to 6 percent slopes
14C	Spinks sand, 6 to 12 percent slopes
14D	Spinks sand, 12 to 25 percent slopes
15A	Teasdale fine sandy loam, 0 to 3 percent slopes
16A	Brady sandy loam, 0 to 3 percent slopes
17	Barry loam
18	Gilford–Colwood complex
20	Houghton muck
22	Cohoctah fine sandy loam
29A	Kibbie fine sandy loam, 0 to 3 percent slopes
30	Edwards muck
35B	Arkport–Okee loamy fine sands, 2 to 6 percent slopes
35C	Arkport–Okee loamy fine sands, 6 to 12 percent slopes
35D	Arkport–Okee loamy fine sands, 12 to 25 percent slopes
37	Palms muck
39A	Ypsi–Wauseon complex, 0 to 3 percent slopes
40	Lenawee silt loam
42A	Riddles sandy loam, 0 to 2 percent slopes
42B	Riddles sandy loam, 2 to 6 percent slopes
42C	Riddles sandy loam, 6 to 12 percent slopes
42D	Riddles sandy loam, 12 to 18 percent slopes
43A	Dixboro very fine sandy loam, 0 to 3 percent slopes
44B	Leoni gravelly sandy loam, 2 to 6 percent slopes
44C	Leoni gravelly sandy loam, 6 to 12 percent slopes
44D	Leoni gravelly sandy loam, 12 to 18 percent slopes
45	Martisco muck
46	Sebewa loam
47	Histosols and Aquents, ponded
48	Napoleon muck
49B	Hillsdale–Riddles sandy loams, 1 to 6 percent slopes
49C	Hillsdale–Riddles sandy loams, 6 to 12 percent slopes
49D	Hillsdale–Riddles sandy loams, 12 to 18 percent slopes
49E	Hillsdale–Riddles sandy loams, 18 to 30 percent slopes
51	Udorthents and Udipsamments, nearly level
52	Pits, gravel
53	Pits, quarries
55B	Eleva sandy loam, 1 to 6 percent slopes
55C	Eleva sandy loam, 6 to 12 percent slopes
56D	Riddles–Leoni complex, 10 to 20 percent slopes
57A	Urban land–Barry–Brady complex, 0 to 3 percent slopes
58B	Urban land–Oshtemo complex, 0 to 6 percent slopes
58C	Urban land–Oshtemo complex, 6 to 15 percent slopes
59B	Urban land–Riddles complex, 0 to 6 percent slopes
59C	Urban land–Riddles complex, 6 to 15 percent slopes
60	Urban land–Udorthents complex
61B	Sayresville silt loam, 2 to 8 percent slopes
62A	Del Rey silt loam, 0 to 3 percent slopes
63	Henrietta muck
64B	Marlette–Owosso complex, 2 to 6 percent slopes
64C	Marlette–Owosso complex, 6 to 12 percent slopes
65A	Capac loam, 0 to 3 percent slopes
66E	Eleva Variant channery fine sandy loam, 15 to 30 percent slopes
67B	Whalan loam, 1 to 6 percent slopes
68B	Oshtemo–Leoni complex, 1 to 6 percent slopes
68C	Oshtemo–Leoni complex, 6 to 12 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip, FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water, w)
- Intermittent (int)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (18, 44B)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

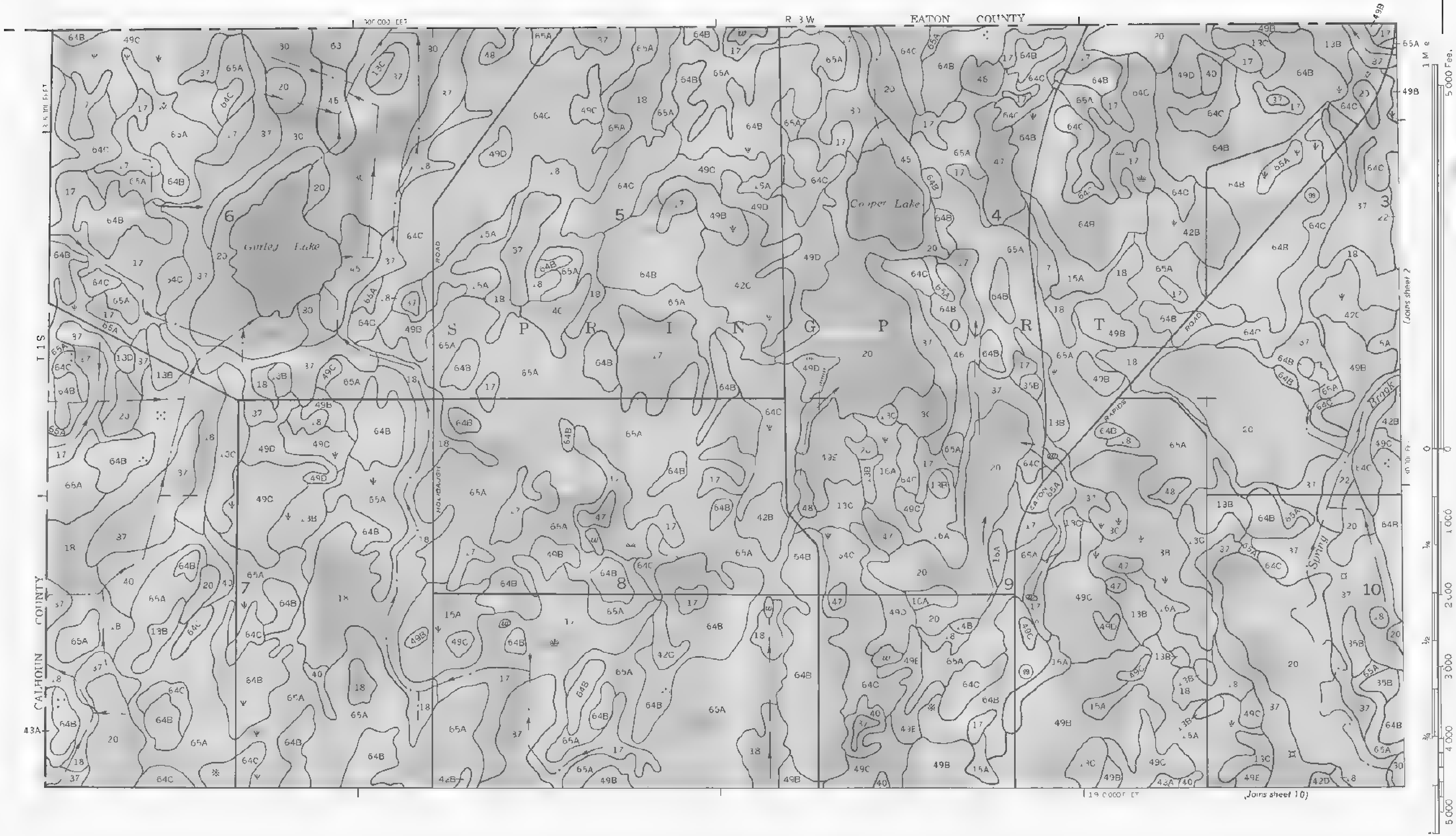
GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) (S)

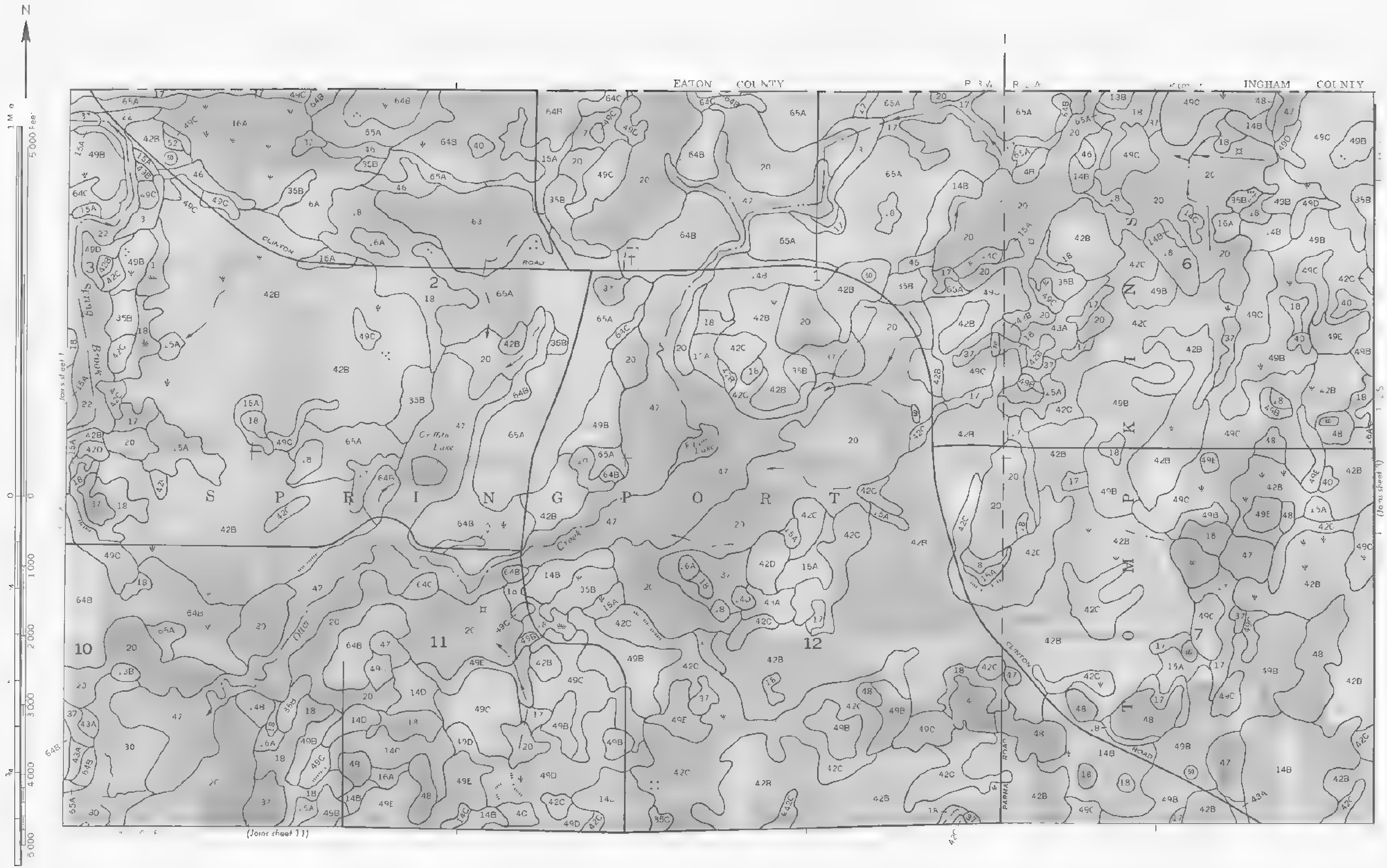
MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Cobbly spot
- Spot of mineral soil in an organic soil area
- Bedrock at a depth of 20 to 60 inches



1
N
EATON COUNTY
R. 3 W.
T. 1 S.
CALHOUN COUNTY
S P R I N G P O R T
Gurley Lake
Cooper Lake
Spring Brook
ROAD
RAPIDS ROAD
(Joins sheet 2)
(Joins sheet 10)
1 Mile
5000 Feet
1
2
3
4
5
6
7
8
9
10

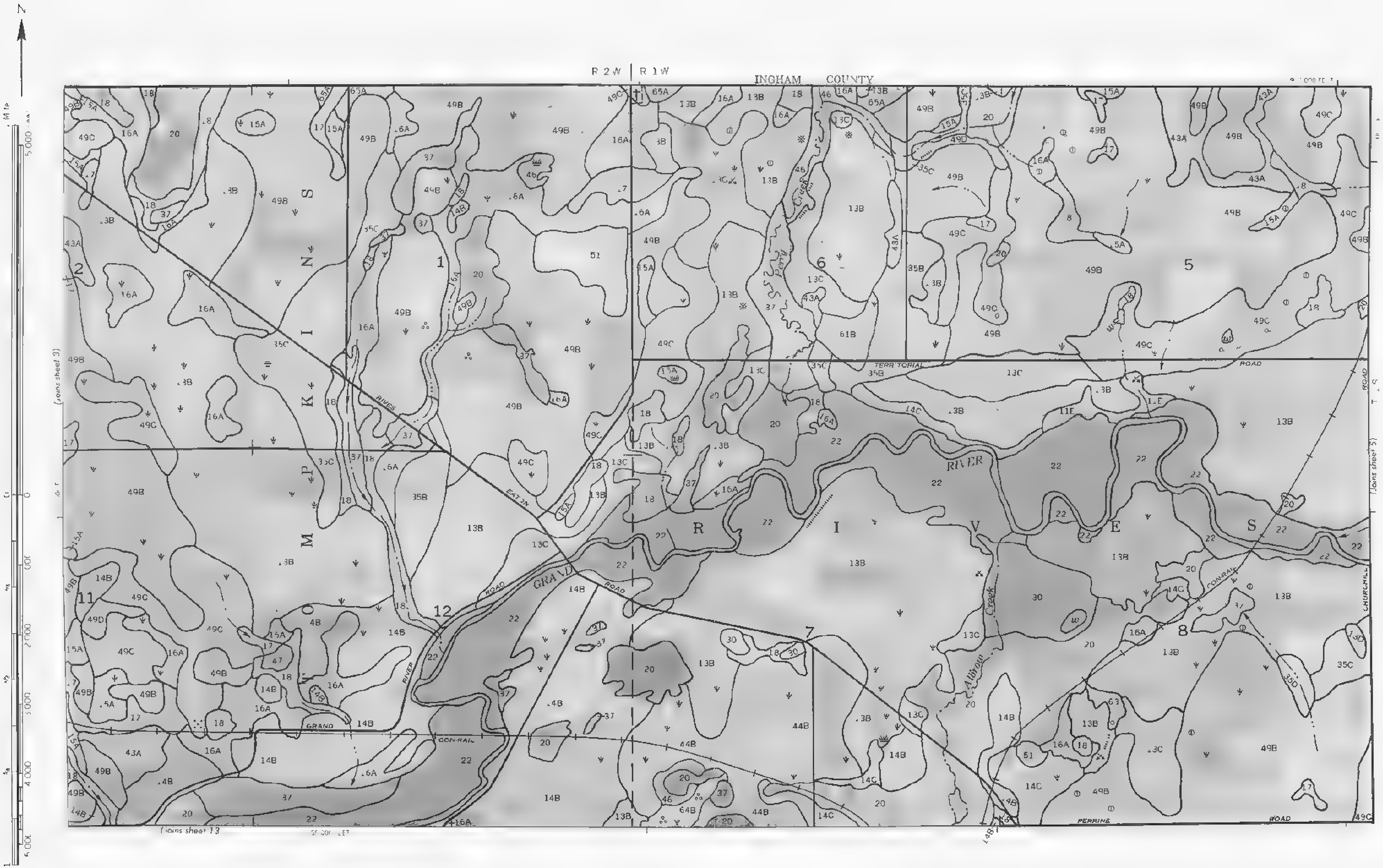
2

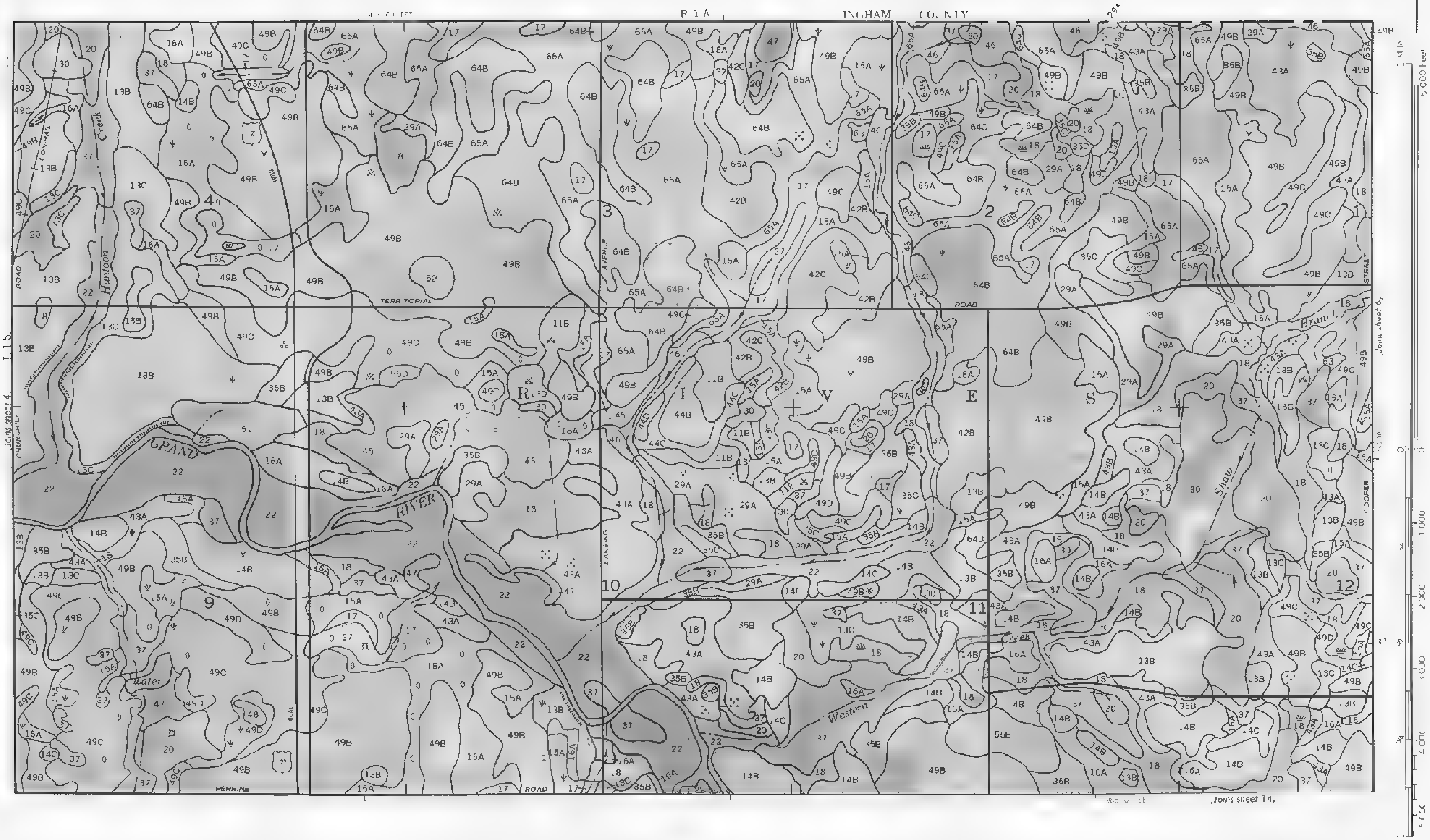

N
EATON COUNTY
INGHAM COUNTY
S P R I N G P O R T
CLINTON ROAD
PARMA ROAD
(Joins sheet 11)

JACKSON COUNTY, MICHIGAN — SHEET NUMBER 3

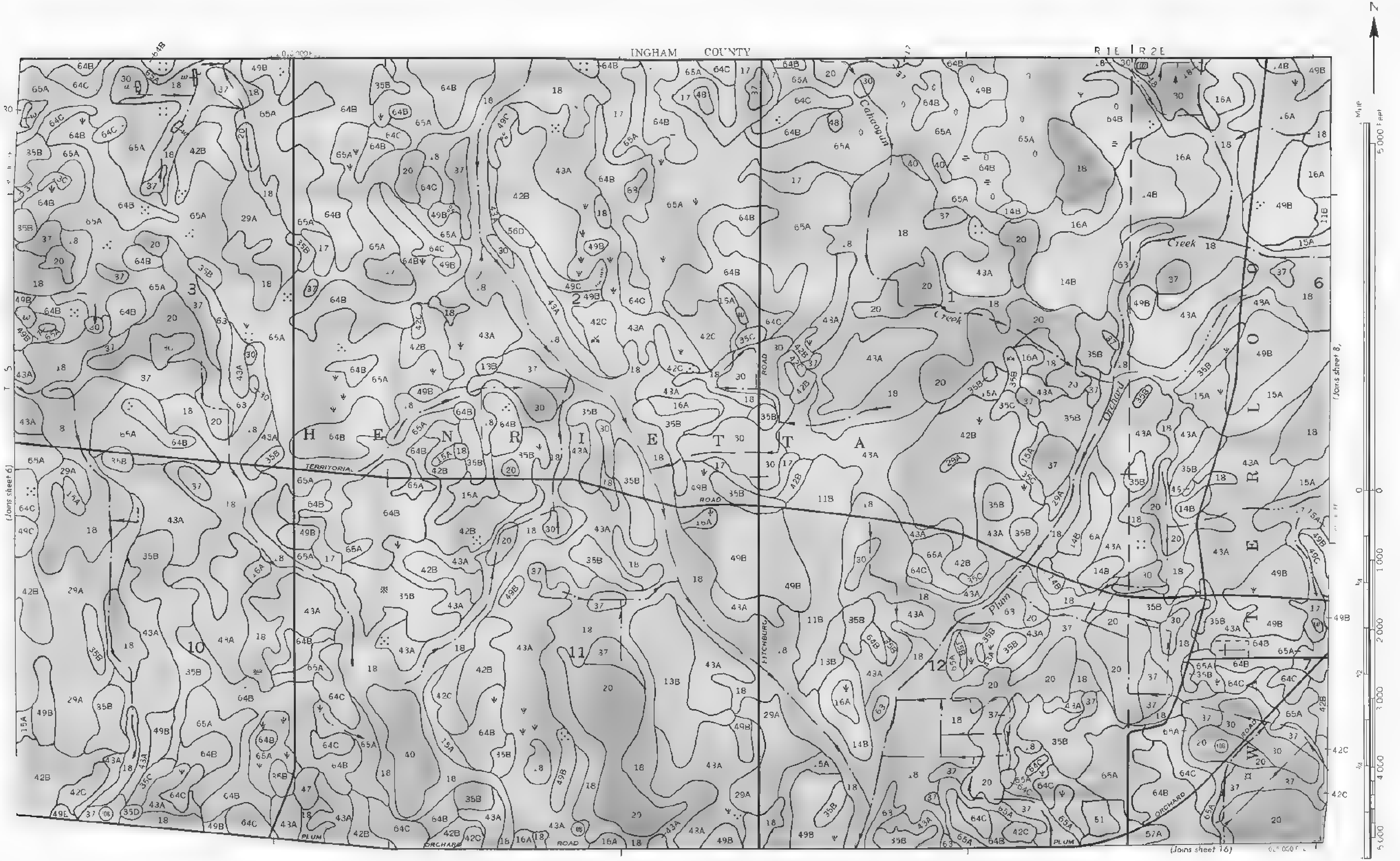
(3)

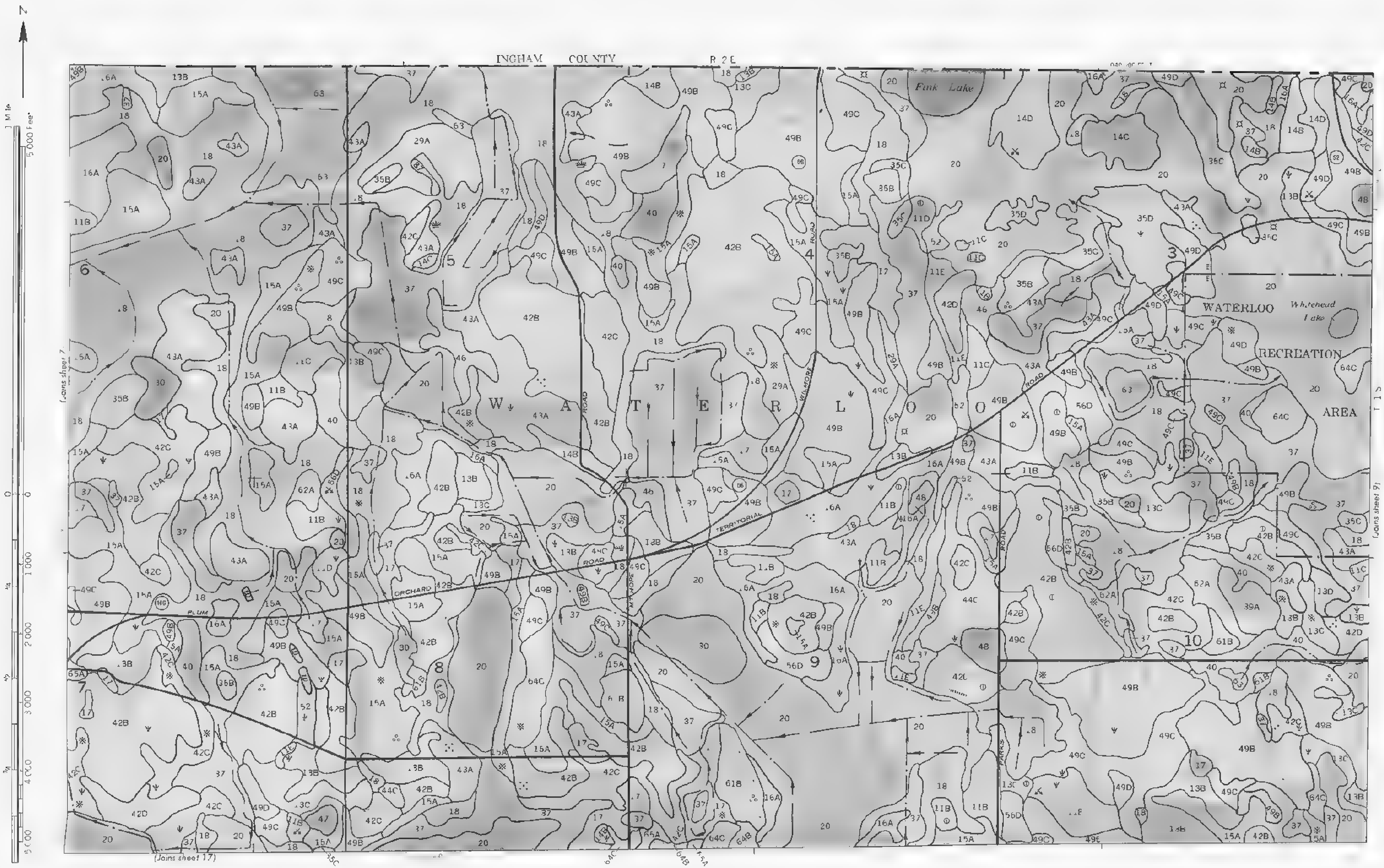
4

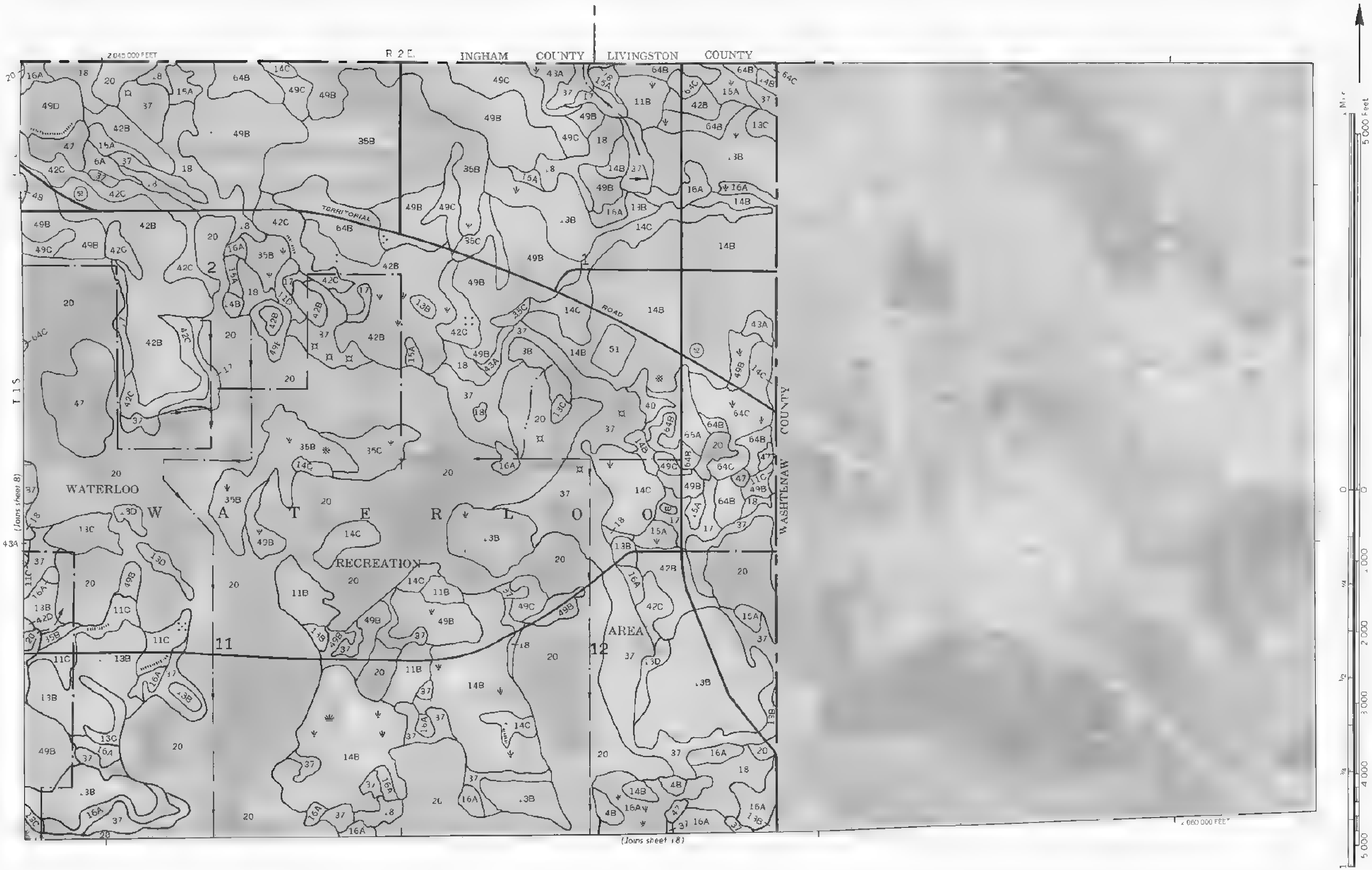

R 2 W
R 1 W
INGHAM COUNTY
TERRITORIAL ROAD
GRAND RIVER
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 13)
CON-RAIL
PERRINE ROAD
CHURCHILL ROAD
RIVES

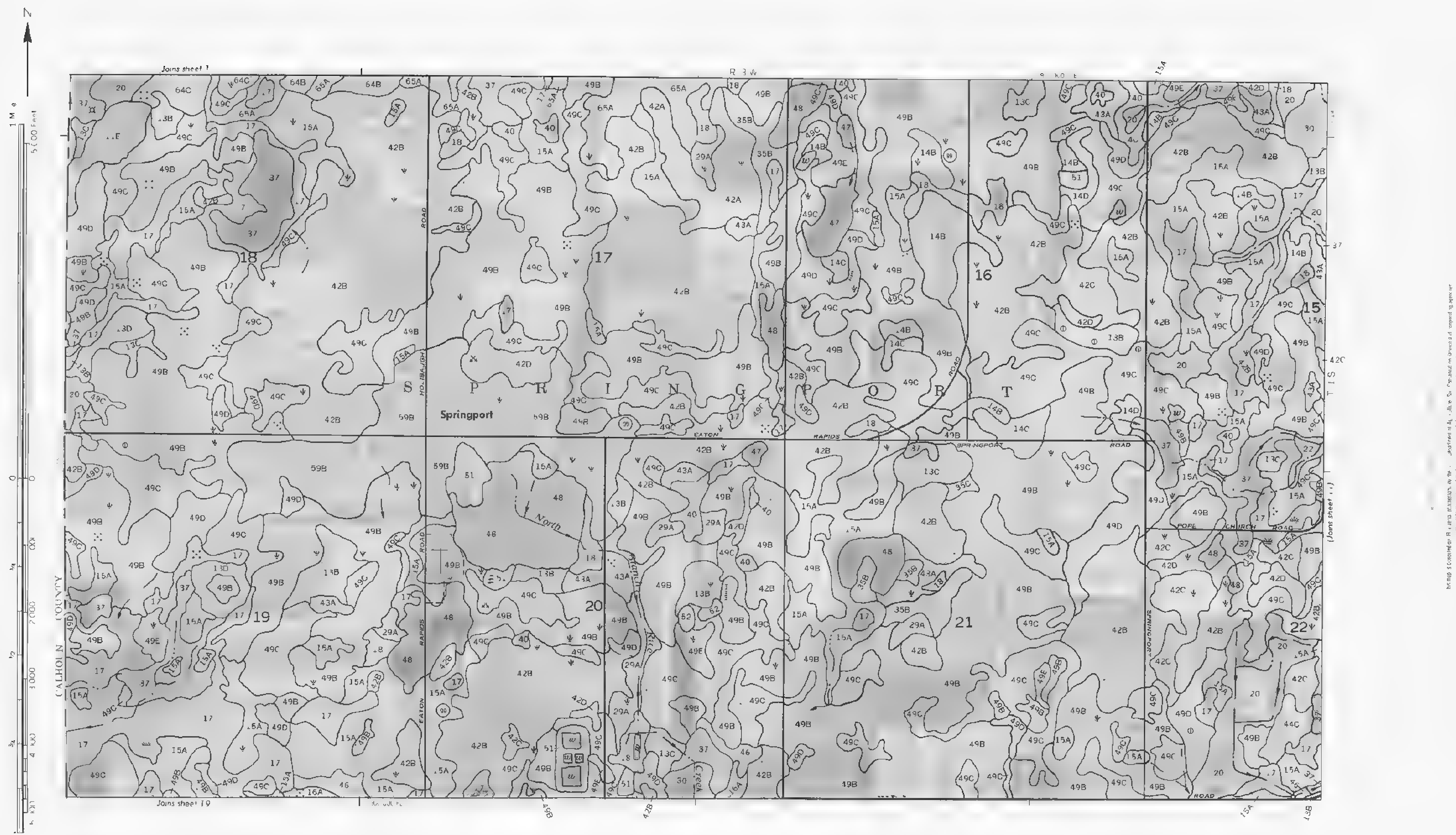

N
R 1 W
INGHAM COUNTY
TERRITORIAL ROAD
GRAND RIVER
Huntoon Creek
LANSING AVENUE
PERRINE ROAD
Branch
Shaw
Western Creek
COOPER STREET
Water
Joins sheet 4
Joins sheet 6
Joins sheet 14
1 Mile
5000 Feet
1000
2000
3000
4000
5000

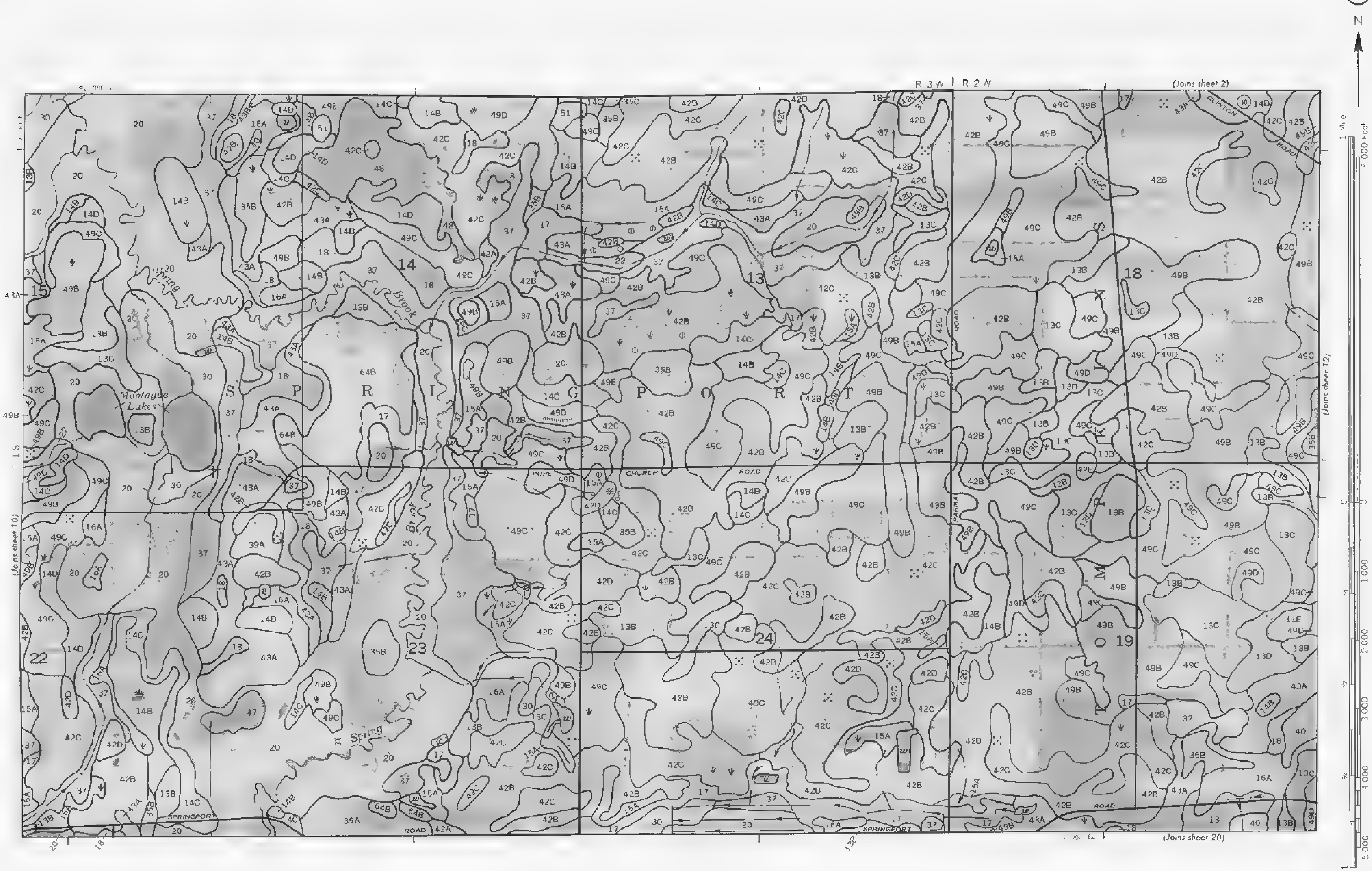

INGHAM COUNTY
INGHAM COUNTY
R 1 E
HENRIETTA
TERRITORIAL ROAD
NORTH MERIDIAN ROAD
STYLES ROAD
BUNKERHILL ROAD
PLEASANT LAKE
BATTEESE LAKE
Batteese Creek
Shaw Branch
PLUM
ORCHARD ROAD
(Joins sheet 5)
(Joins sheet 7)
(Joins sheet 15)
T 1 S
1
4
5
6
7
8
9
12


INGHAM COUNTY
R 1 E
R 2 E
N
H E N R I E T T A
L E R O Y
TERRITORIAL
ROAD
FITCHBURG
ROAD
PLUM
ORCHARD
Cahoogan
Creek
Orchard
Plum
(Joins sheet 6)
(Joins sheet 8)
(Joins sheet 16)
1
2
3
6
7
10
11
12
1 Mile
5 000 Feet
1 000
2 000
3 000
4 000
5 000

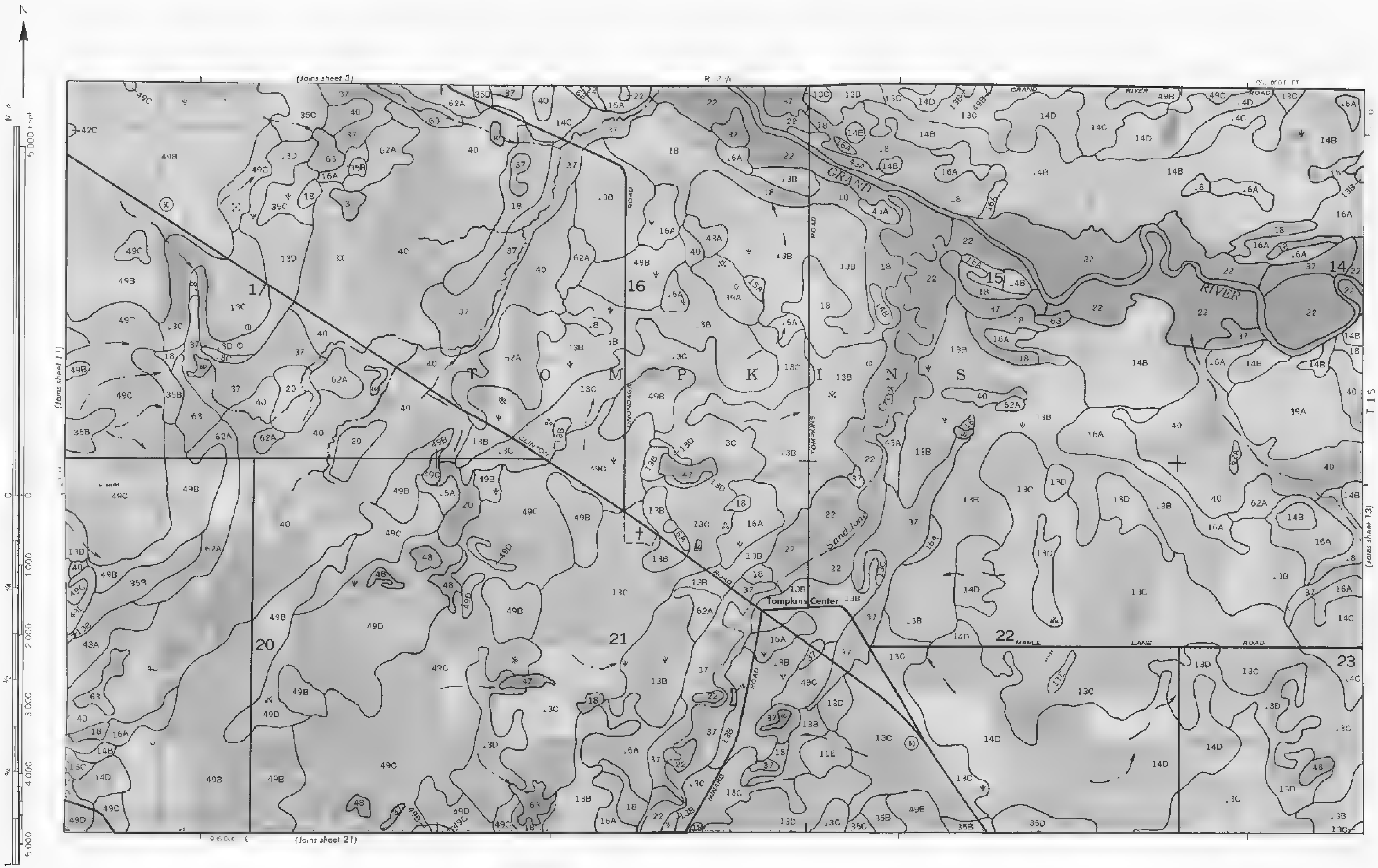

N
1 Mile
5 000 Feet
INGHAM COUNTY
R 2 E
Fink Lake
WATERLOO
Whitehead Lake
RECREATION
AREA
W A T E R L O O
TERRITORIAL ROAD
ORCHARD ROAD
PLUM
WILMORE ROAD
PARKS ROAD
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 17)
T 1 S


R 2 E.
INGHAM COUNTY
LIVINGSTON COUNTY
WASHTENAW COUNTY
T 1 S.
TERRITORIAL ROAD
WATERLOO
W A T E R L O O
RECREATION
AREA
(Joins sheet 8)
(Joins sheet 18)
N
5 000 Feet


N
Joins sheet 19
R 3 W
Springport
S P R I N G P O R T
HOLLIBAUGH ROAD
EATON RAPIDS ROAD
SPRINGPORT ROAD
POPE CHURCH ROAD
CALHOUN COUNTY
North Branch Rice Creek
18
17
16
15
19
20
21
22

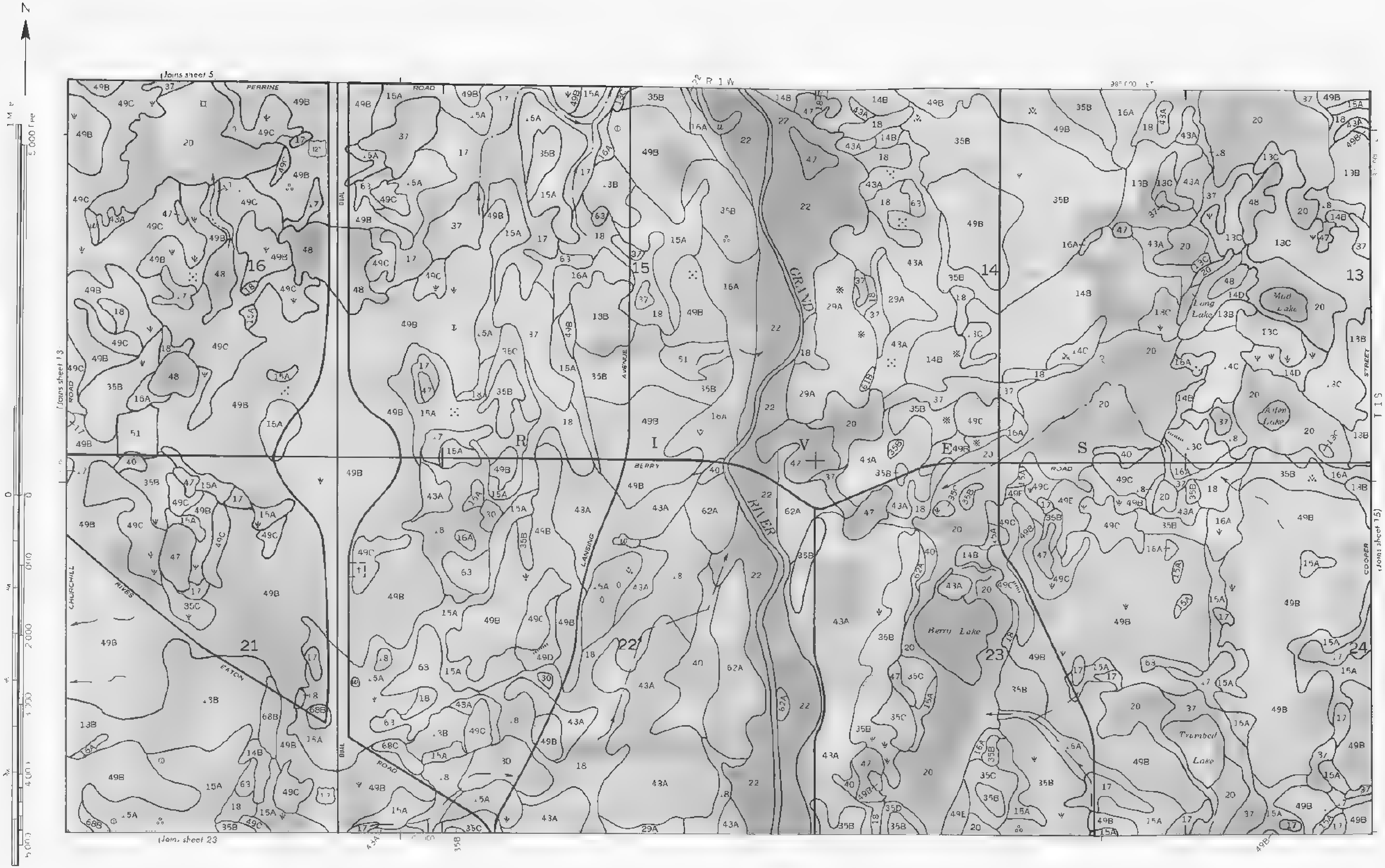

R 3 W
R 2 W
(Joins sheet 2)
(Joins sheet 20)
(Joins sheet 10)
(Joins sheet 12)
T 1 S
Montague Lakes
Spring Brook
Brook
Spring
POPE CHURCH ROAD
PARMA ROAD
SPRINGPORT ROAD
CLINTON ROAD
S P R I N G P O R T
T O M P K I N S
N
1 Mile
5 000 Feet

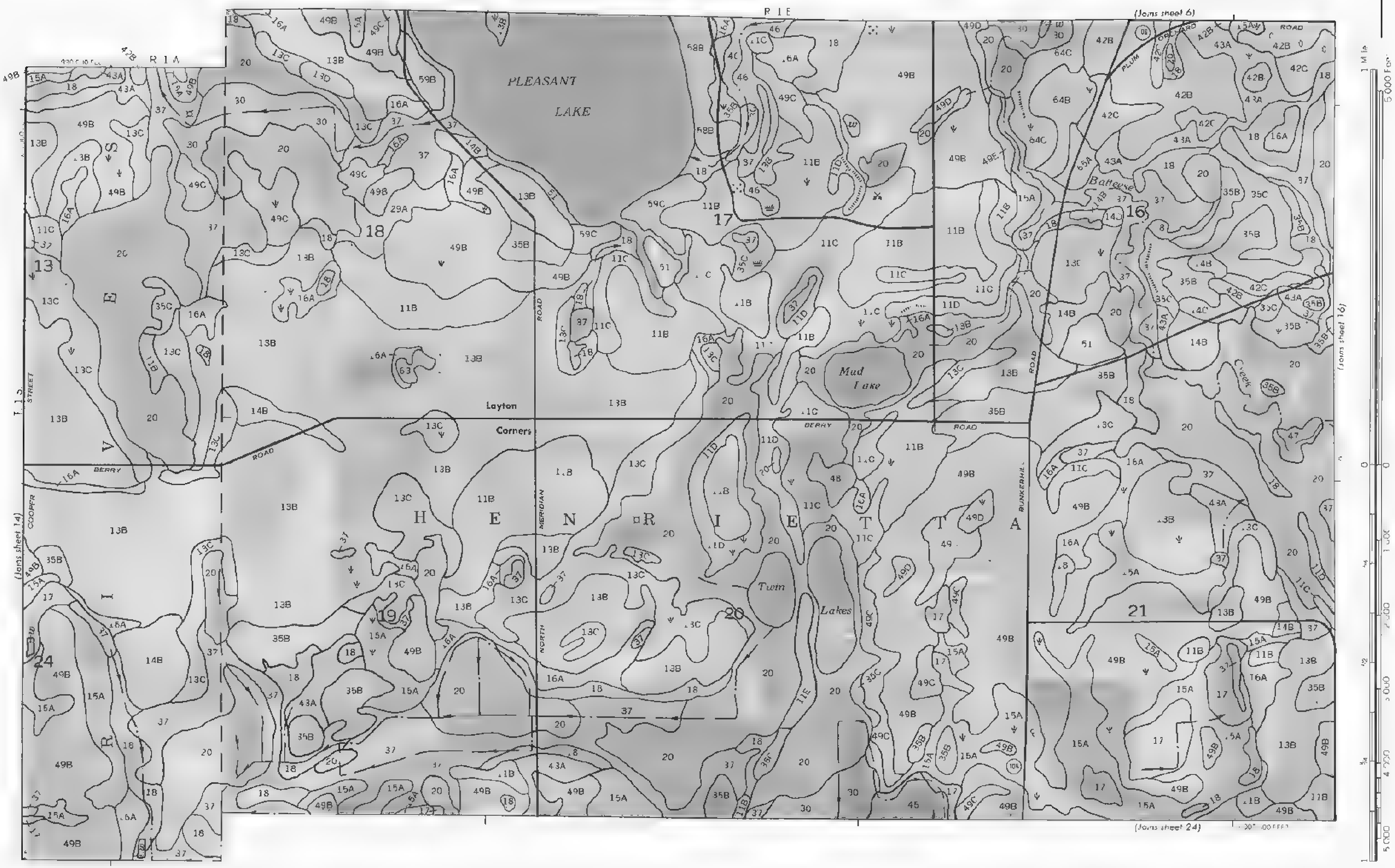
12

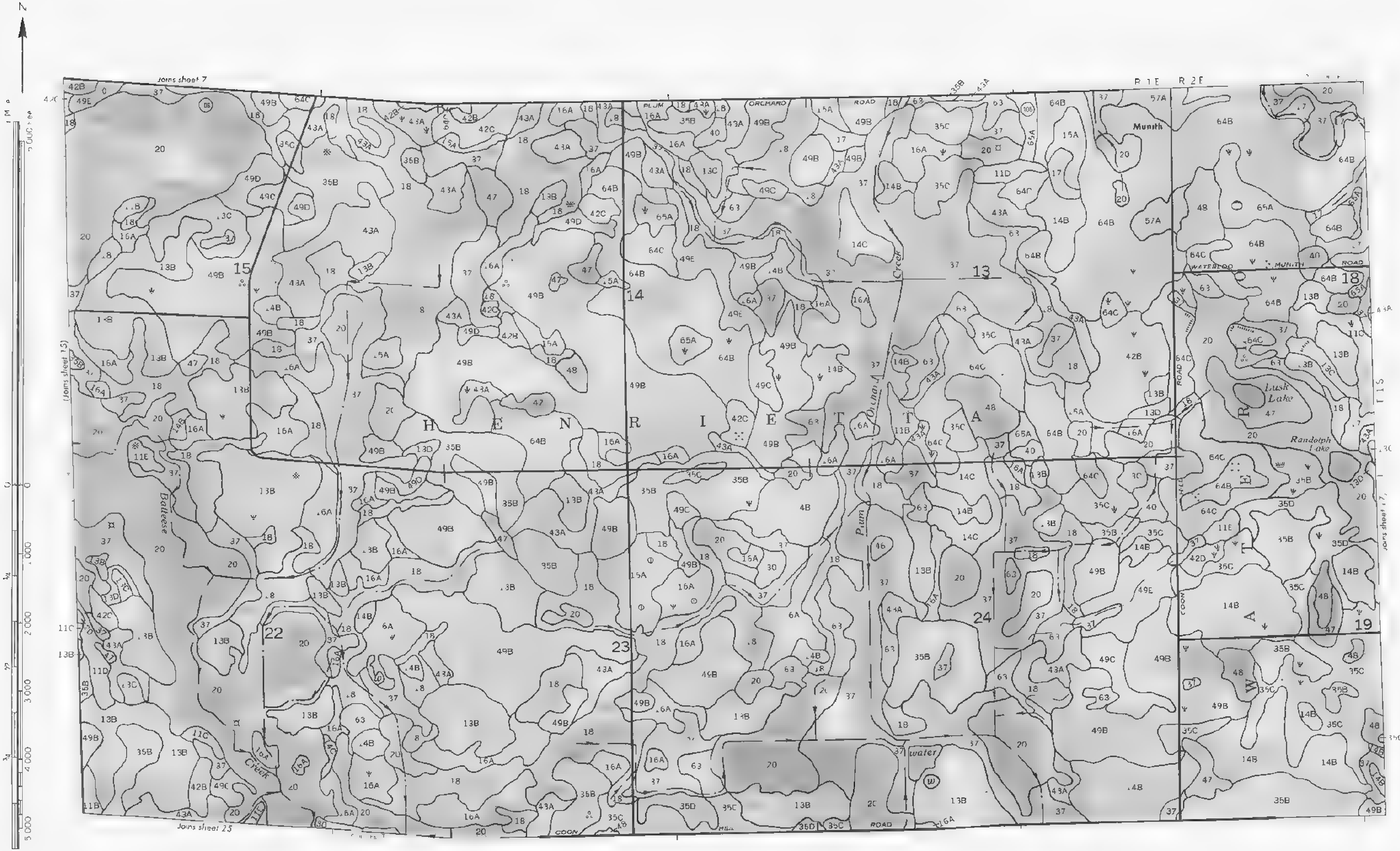

N
(Joins sheet 3)
R 2 W
(Joins sheet 11)
(Joins sheet 13)
(Joins sheet 21)
T 1 S
T O M P K I N S
GRAND RIVER
Sandstone Creek
Tompkins Center
CLINTON ROAD
ONONDAGA ROAD
TOMPKINS ROAD
MINARD ROAD
MAPLE LANE ROAD
5 000 Feet

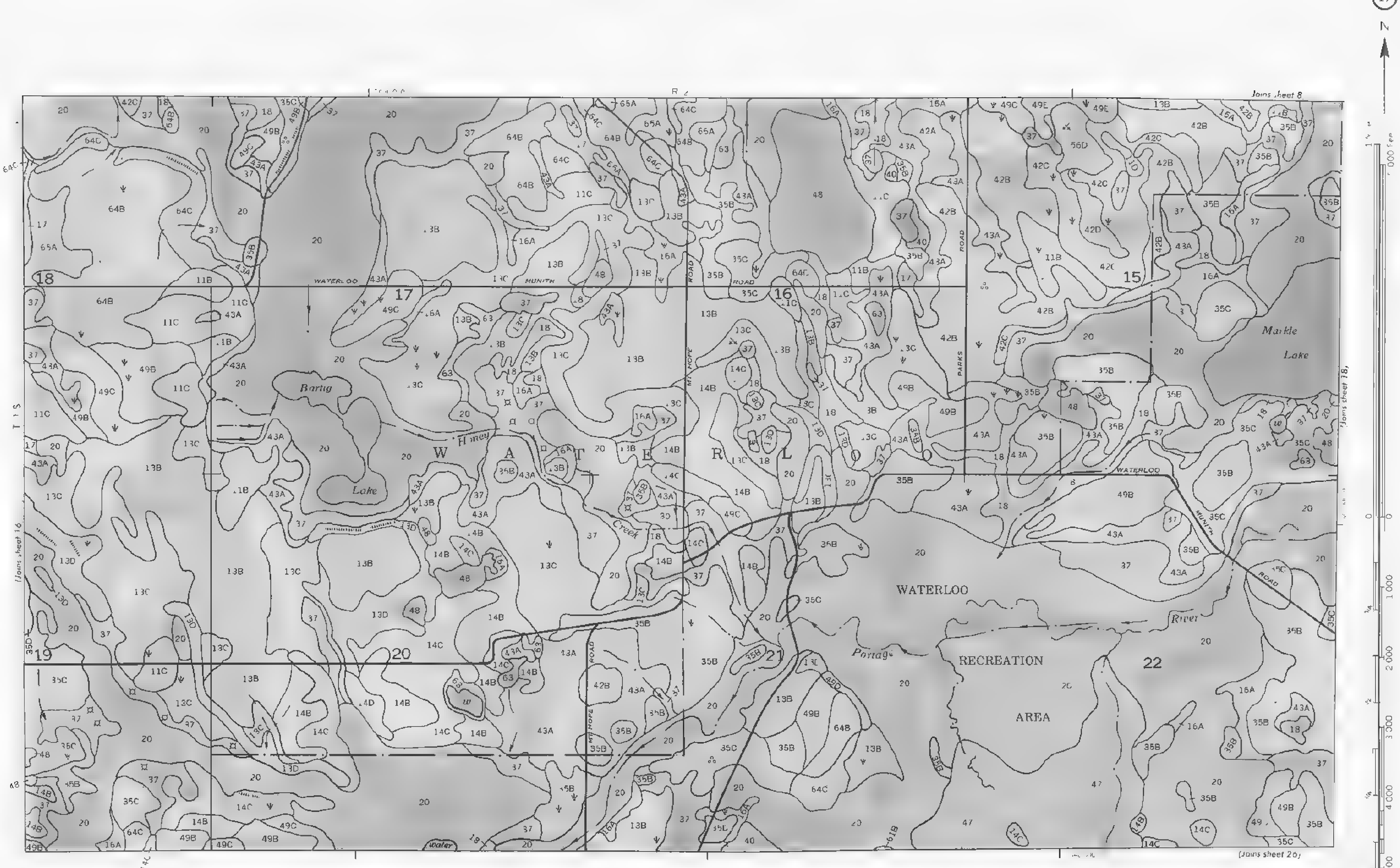

R 2 W
R 1 W
T 1 S
(Joins sheet 4)
(Joins sheet 22)
(Joins sheet 12)
(Joins sheet 14)
Rives Junction
GRAND RIVER
TOMPKINS
RIVES
PERRINE ROAD
WOOD ROAD
MAPLE LANE
ROAD
BERRY ROAD
EATON ROAD
RIVES JUNCTION ROAD
CHURCHILL ROAD
CONRAIL
water
N
1 Mile
5 000 Feet

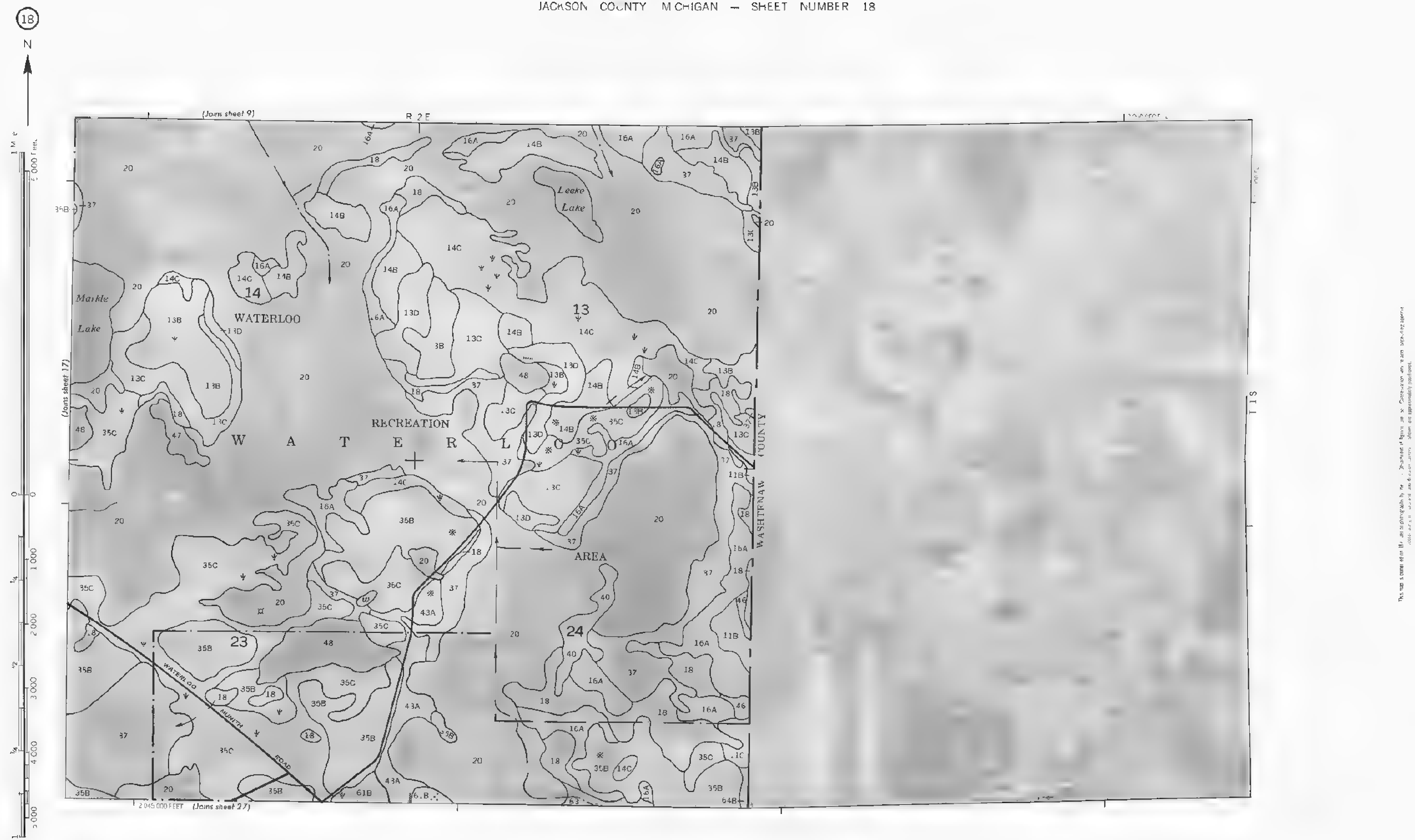
JACKSON COUNTY, MICHIGAN — SHEET NUMBER 14



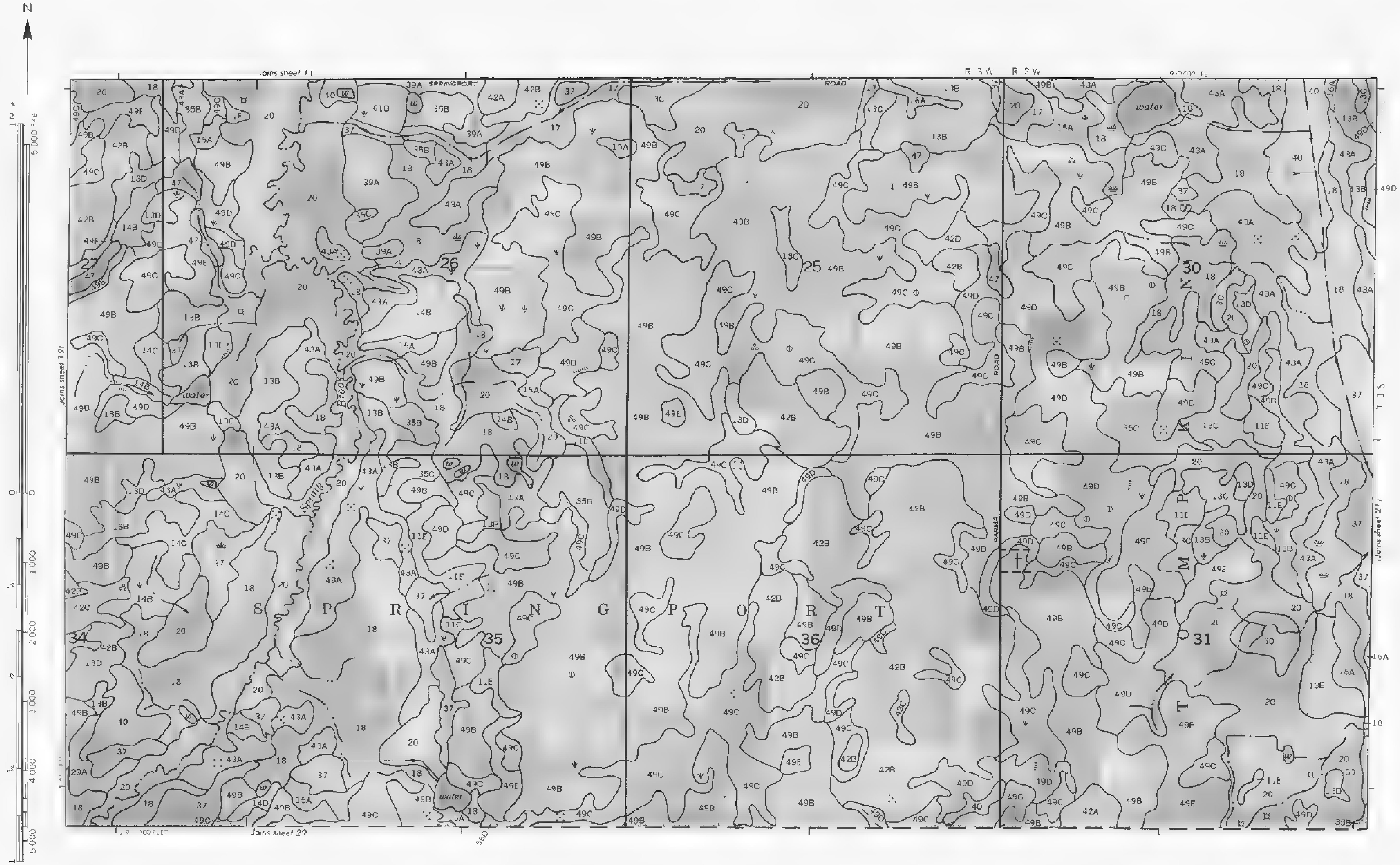

N
R 1 E
R 1 W
(Joins sheet 6)
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 24)
PLEASANT LAKE
Mud Lake
Twin Lakes
Layton Corners
Batteese Creek
BERRY ROAD
NORTH MERIDIAN ROAD
BUNKERHILL ROAD
COOPER STREET
PLUM ORCHARD ROAD
H E N R I E T T A
V E S I E R
13
16
17
18
19
20
21
24
1 Mile
5 000 Feet

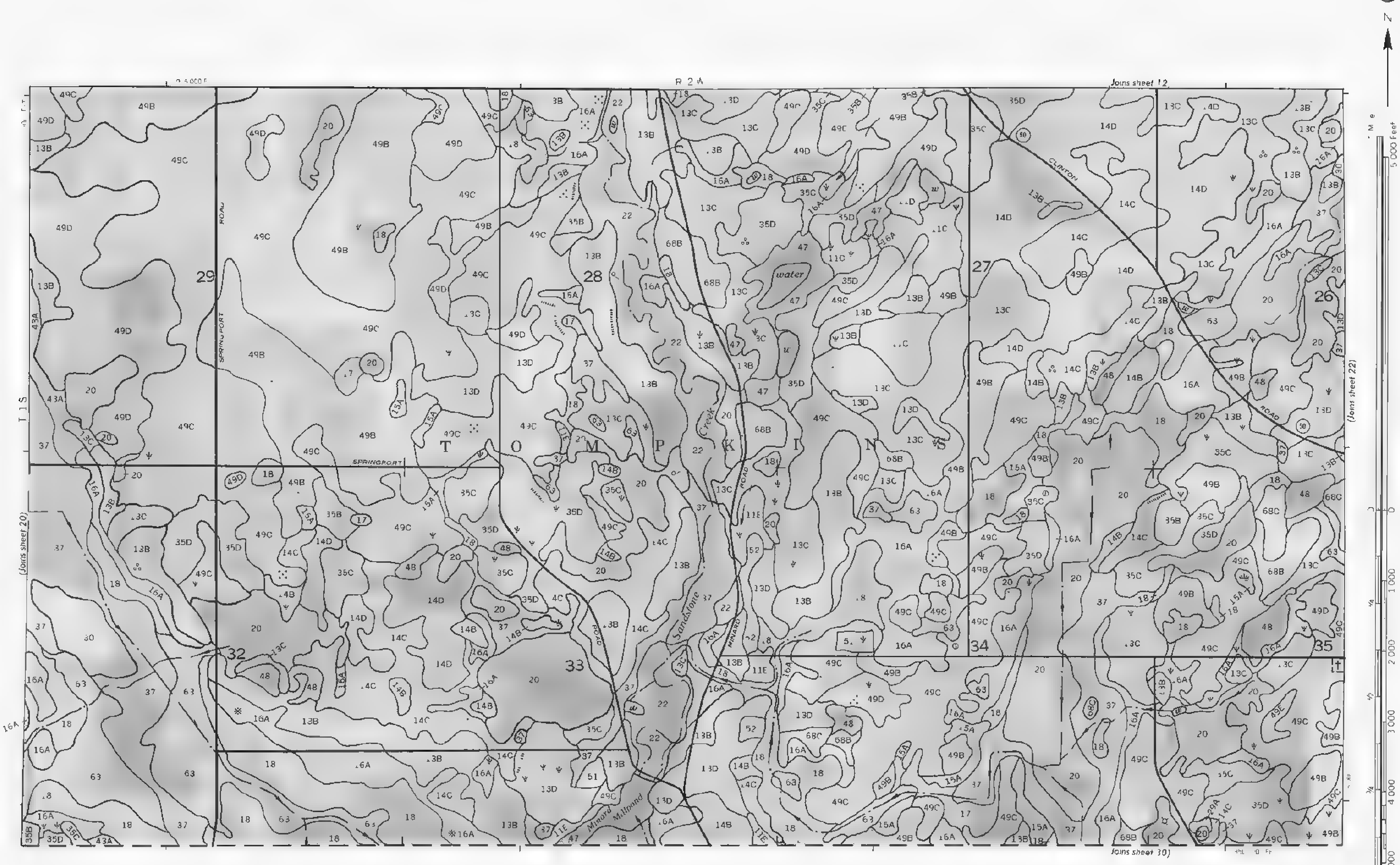

N
Joins sheet 7
Joins sheet 15
Joins sheet 17
Joins sheet 25
R 1 E
R 2 E
T 1 S
Munith
PLUM ORCHARD ROAD
WATERLOO MUNITH ROAD
COON HILL ROAD
Plum Orchard Creek
Batteese Creek
Lusk Lake
Randolph Lake
water
H E N R I E T T A
W A T E R L O O
13
14
15
18
19
22
23
24


17
N
Joins sheet 8
Joins sheet 16
Joins sheet 18
Joins sheet 26
WATERLOO
Bartig
Lake
Honey
Creek
Markle
Lake
WATERLOO
RECREATION
AREA
Portage
River
MT HOPE ROAD
PARKS ROAD
WATERLOO MUNITH ROAD
18
17
16
15
19
20
21
22

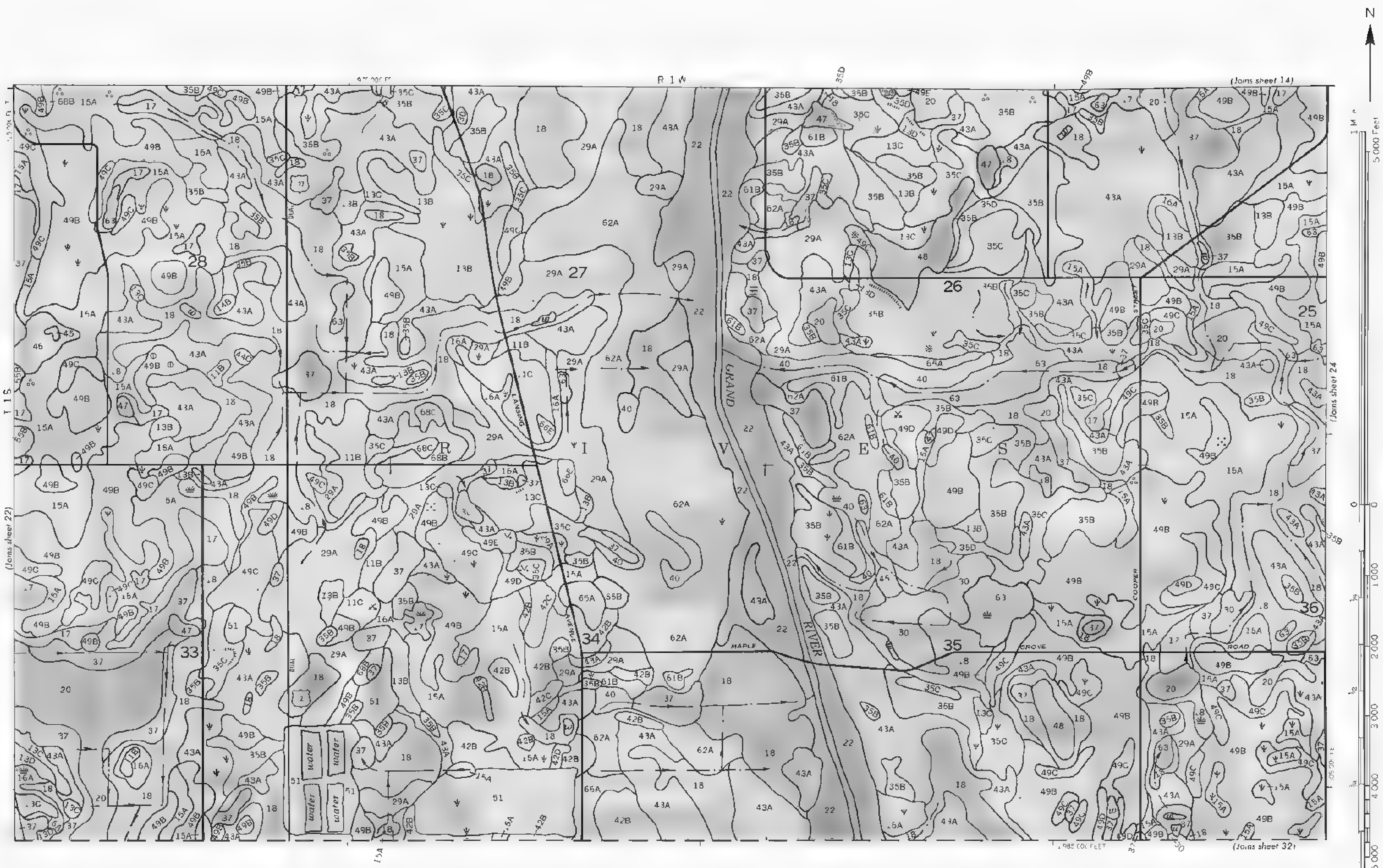

18
N
1 Mile
5 000 Feet
(Joins sheet 9)
R 2 E
(Joins sheet 17)
(Joins sheet 27)
2 045 000 FEET
T 1 S
Markle Lake
Leeke Lake
WATERLOO
RECREATION
W A T E R L O O
AREA
WASHTENAW COUNTY
WATERLOO MUNITH ROAD
14
13
23
24


19
N
R 3 W
Joins sheet 10
Joins sheet 20
(Joins sheet 28
T 1 S
CALHOUN COUNTY
S P R I N G P O R T
North Branch Rice Creek
water
RAPIDS ROAD
EATON
CRAWFORD ROAD
ROAD
29
30
28
27
31
32
33
34
5 000 Feet
0
1000
2000
3000
4000
5000


N
Joins sheet 11
Joins sheet 19
Joins sheet 21
Joins sheet 29
R 3 W
R 2 W
T 1 S
SPRINGPORT
ROAD
PARMA
ROAD
Spring Brook
water
S P R I N G P O R T
T O M P K I N S
25
26
27
30
31
34
35
36

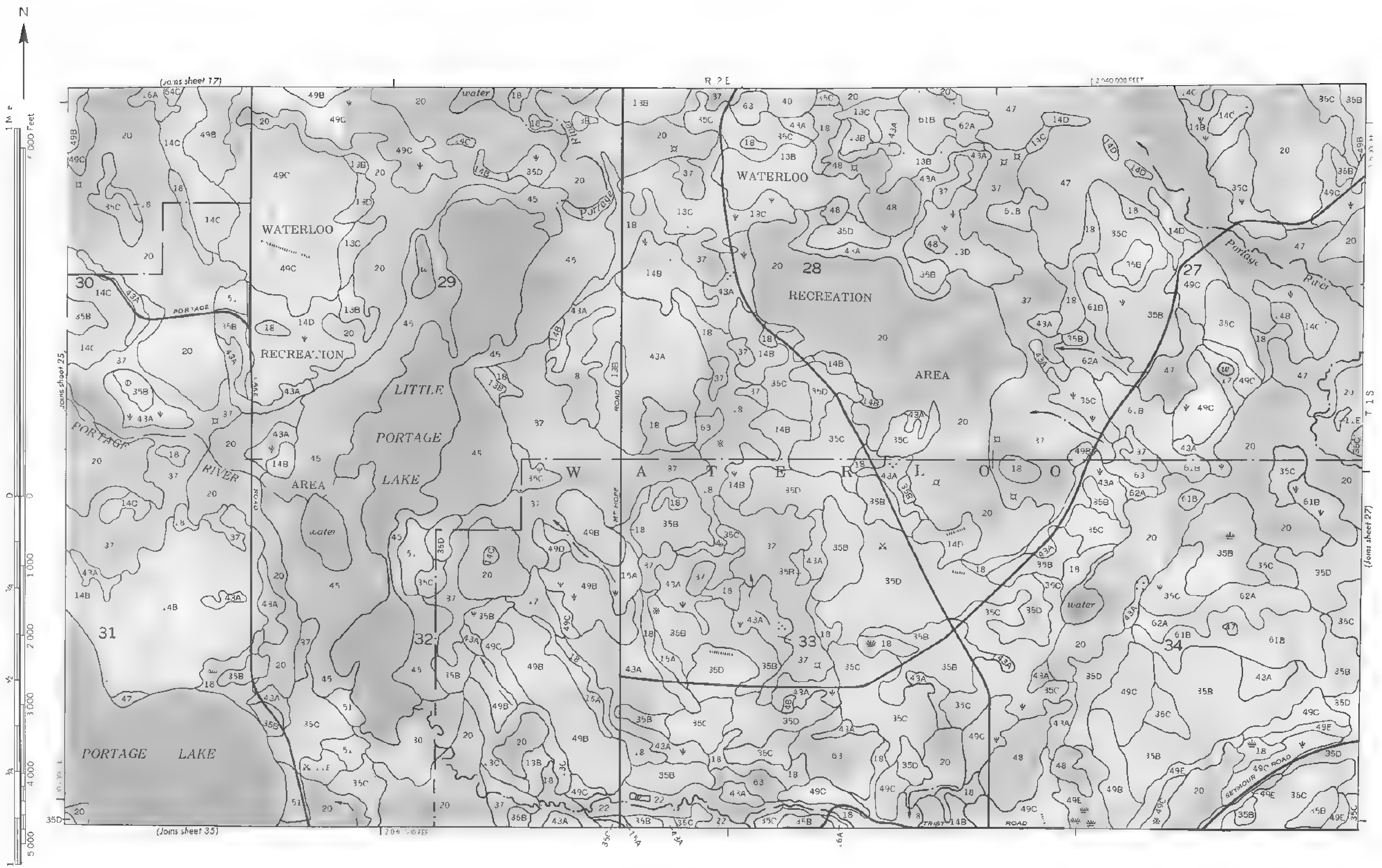

21
N
R 2 W
T 1 S
Joins sheet 12
(Joins sheet 22)
(Joins sheet 20)
Joins sheet 30)
T O M P K I N S
SPRINGPORT ROAD
SPRINGPORT
CLINTON ROAD
MINARD ROAD
Sandstone Creek
Minard Millpond
water
29
28
27
26
32
33
34
35
5 000 Feet

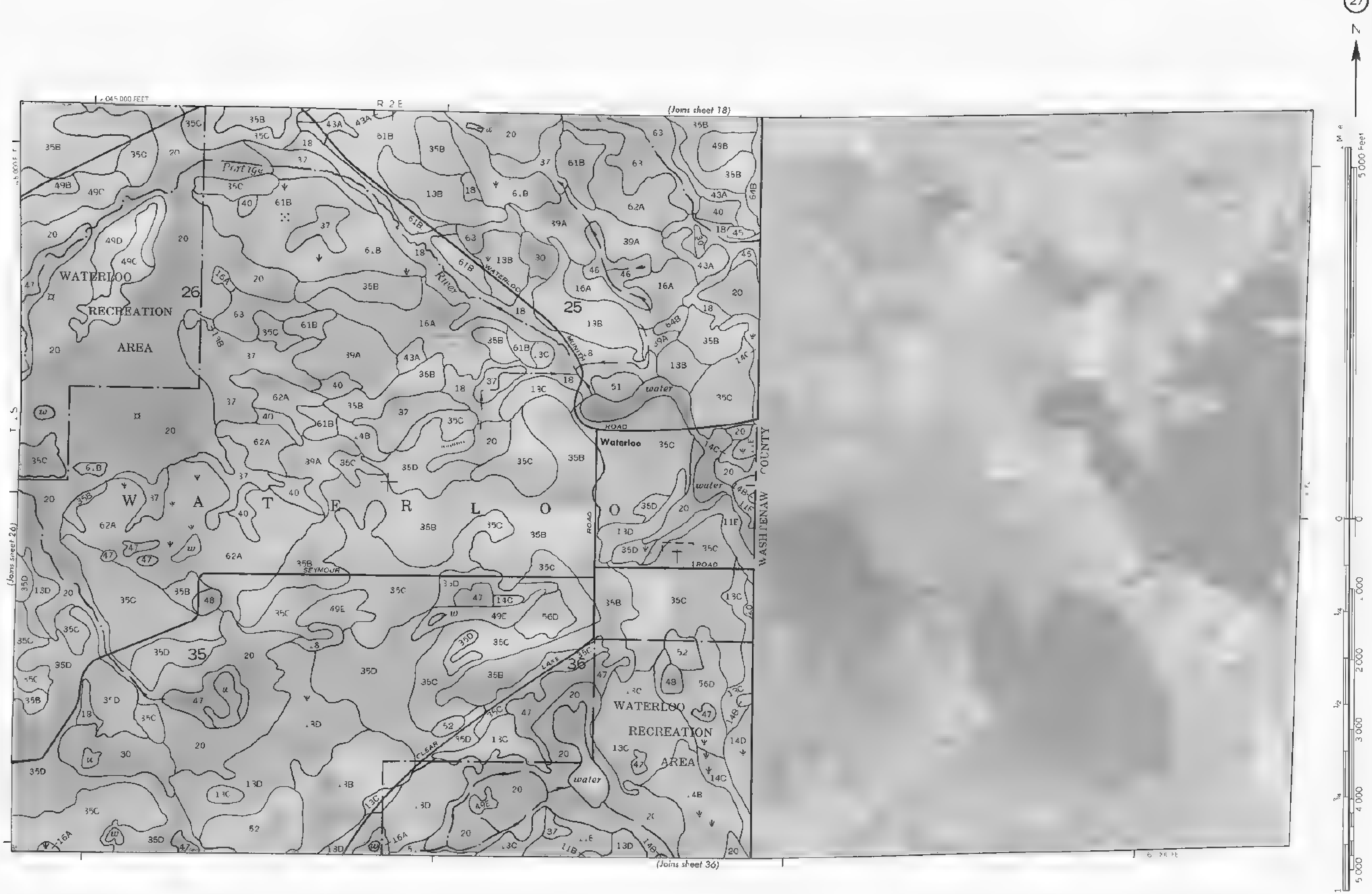

N
1 Mile
5 000 Feet
Joins sheet 13
Joins sheet 21
Joins sheet 23
Joins sheet 31
R 2 W
R 1 W
T 1 S
26
25
30
29
35
36
31
32
FRANKLIN TOWNSHIP
RIVES
water
MAPLE LANE
ROAD
JUNCTION
RIVES
CLINTON ROAD
Albion Creek
CONRAIL

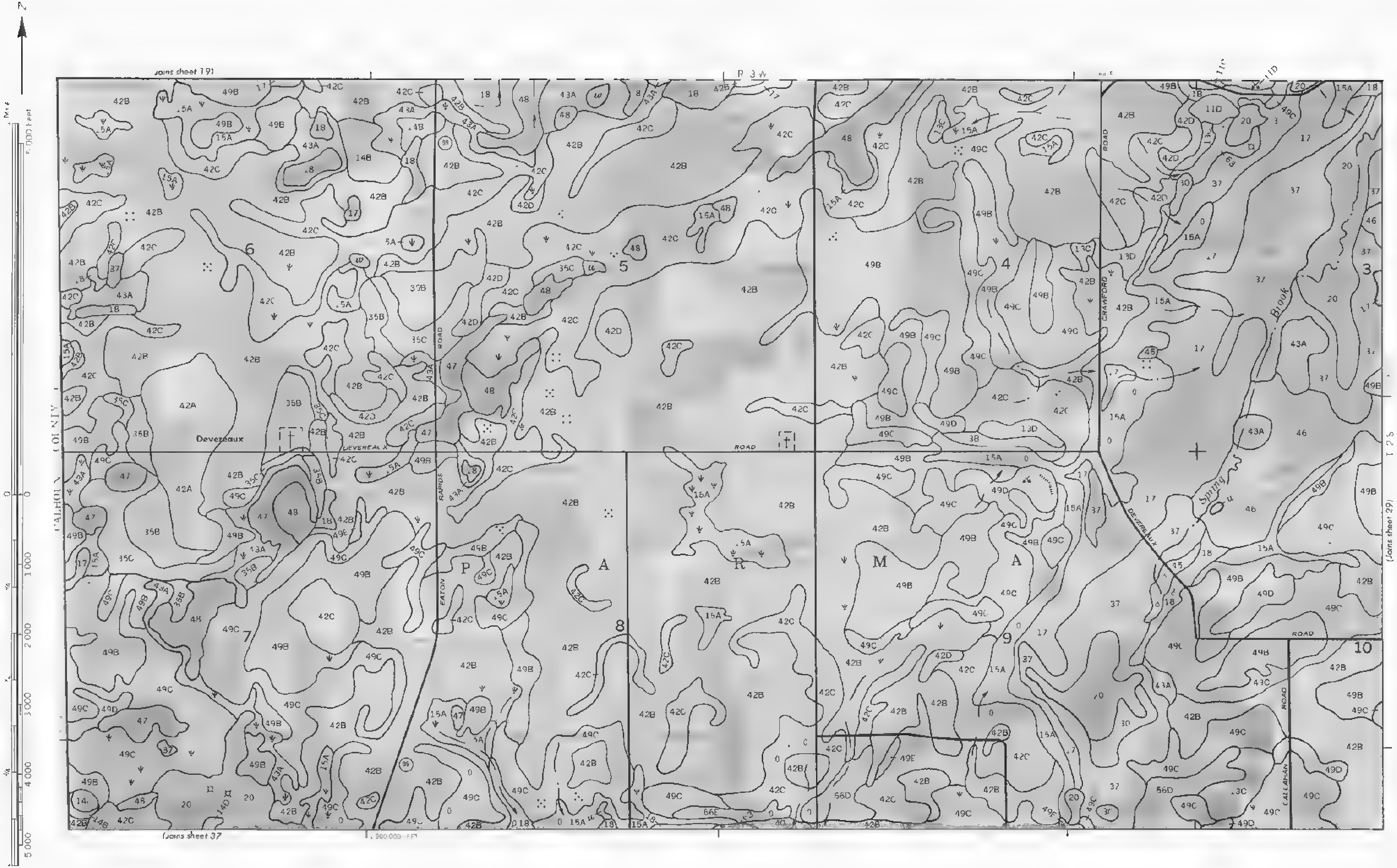

N
(Joins sheet 14)
(Joins sheet 24)
(Joins sheet 32)
(Joins sheet 22)
R 1 W
T 1 S
GRAND
RIVER
MAPLE
GROVE
ROAD
LANSING
AVENUE
COOPER
STREET
V
E
S
T
R
I
25
26
27
28
33
34
35
36
5 000 Feet
1 Mile

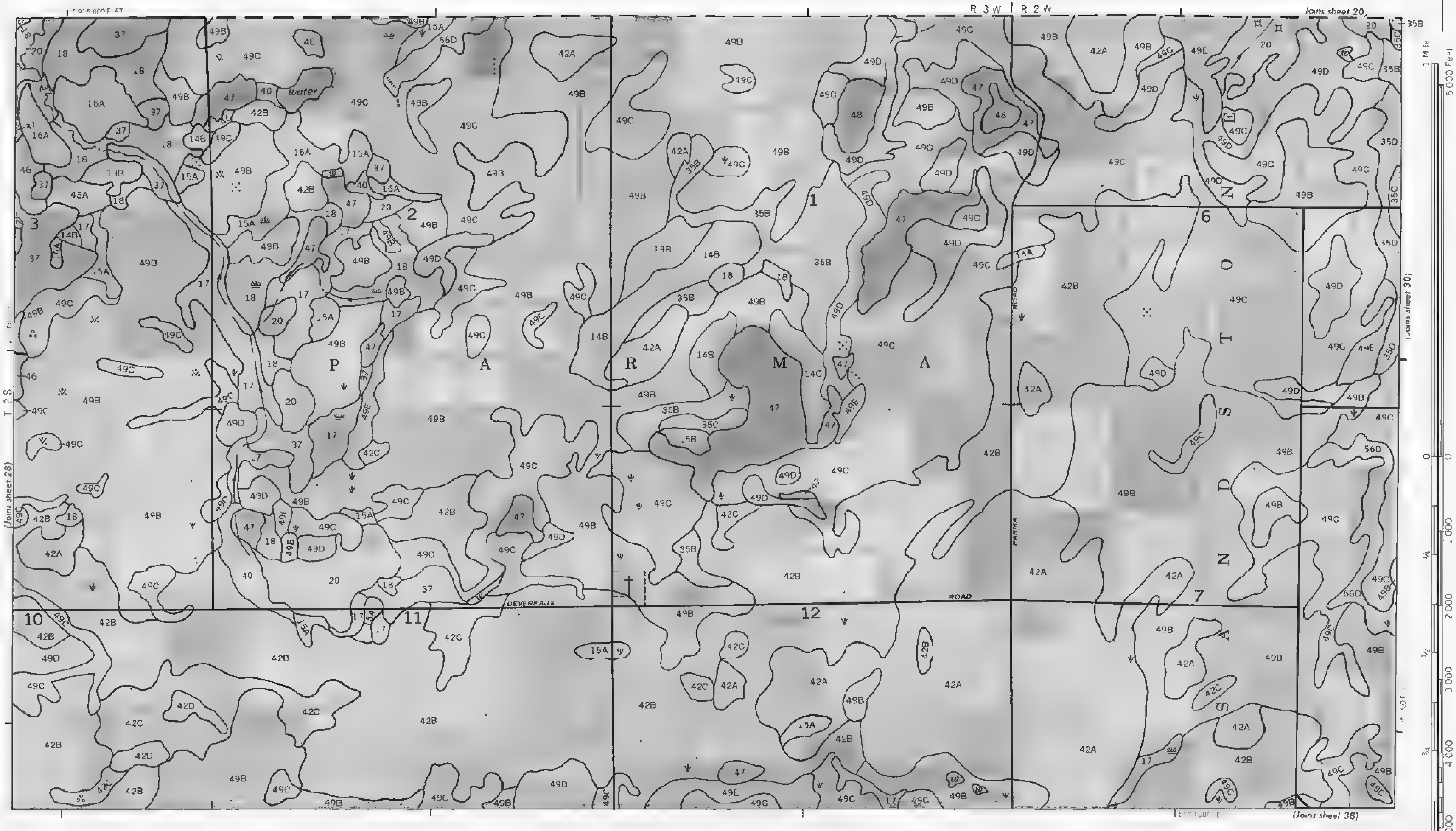

N
5 000 Feet
R. 1 W.
R. 1 E.
T. 1 S.
(Joins sheet 15)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 33)
WHITE LAKE
H E N R I E T T A
COON HILL ROAD
BUNKERHILL ROAD
NORTH MERIDIAN ROAD
WOOSTER ROAD
25
30
29
28
31
32
33
36

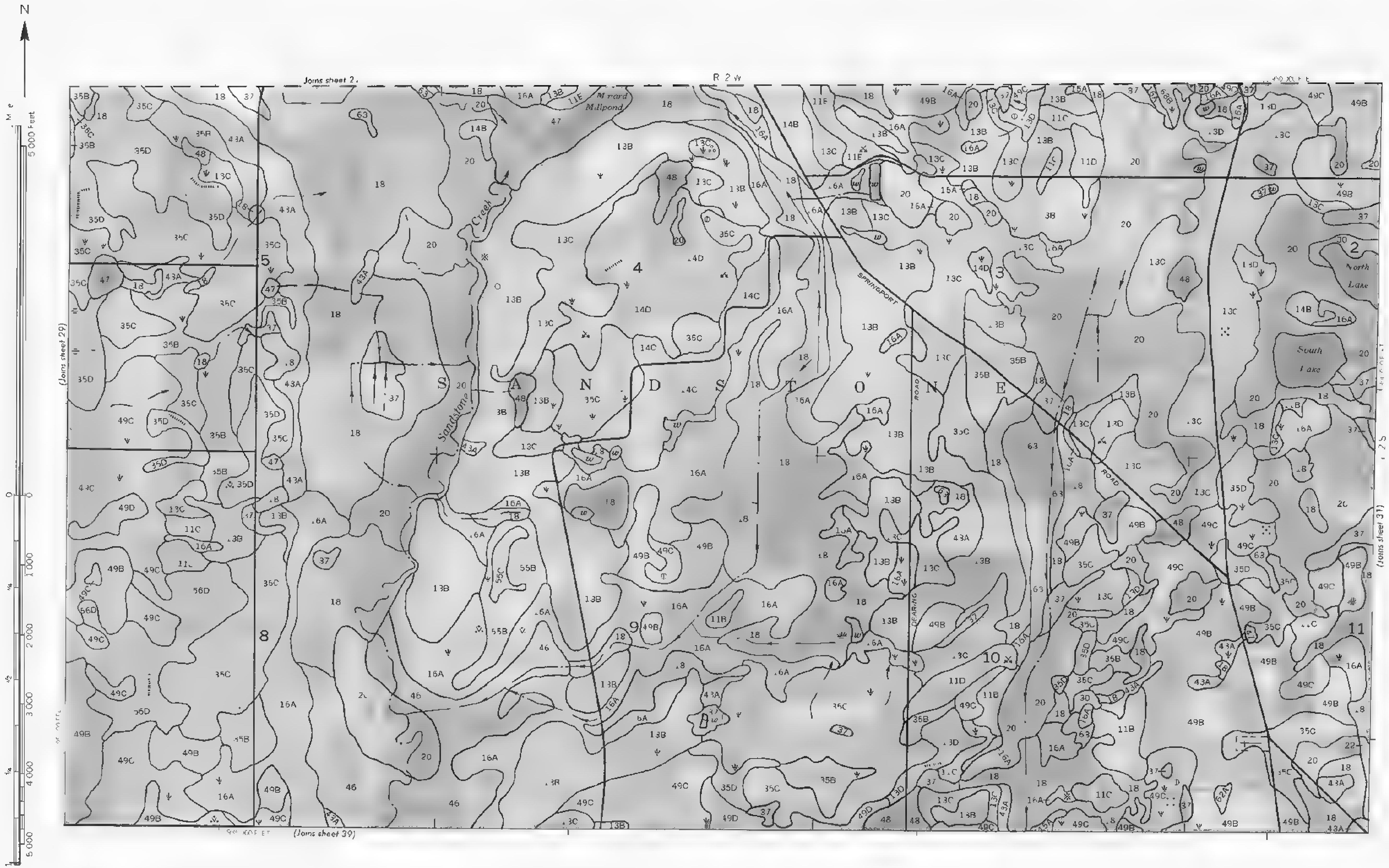

25
N
(Joins sheet 16)
R 1 E
R 2 E
(Joins sheet 24)
(Joins sheet 26)
(Joins sheet 34)
T 1 S
COON HILL ROAD
PORTAGE LAKE ROAD
H E N R I E T T A
W A T E R L O O
PORTAGE RIVER
Portage River
Plum Orchard Creek
Batteese Creek
PORTAGE LAKE
WATERLOO RECREATION AREA
25
26
27
30
31
34
35
36

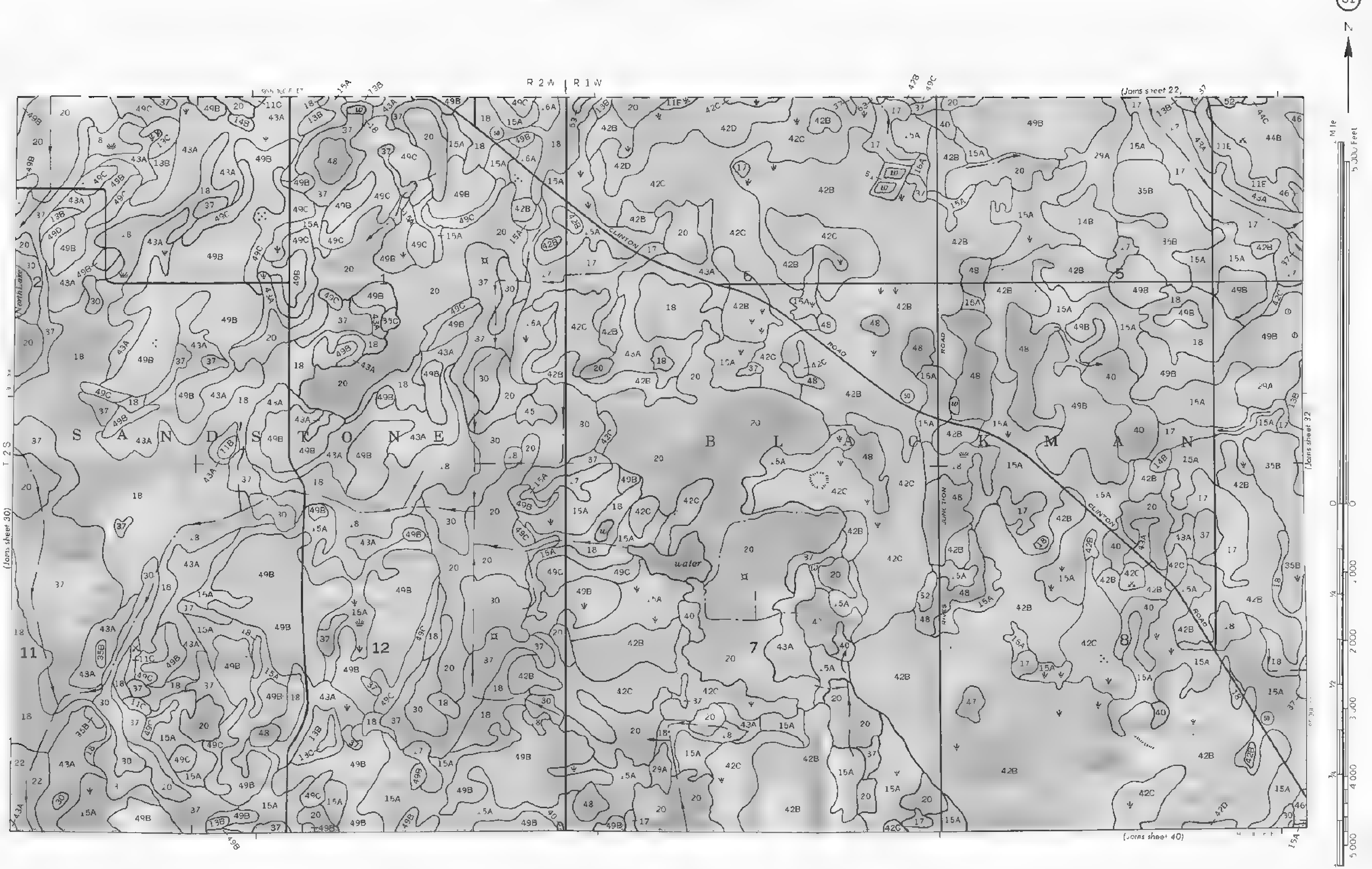

N
1 Mile
5 000 Feet
(Joins sheet 17)
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 35)
R. 2 E.
T. 1 S.
WATERLOO
RECREATION
AREA
LITTLE
PORTAGE
LAKE
PORTAGE LAKE
PORTAGE RIVER
Portage River
W A T E R L O O
29
28
27
30
31
32
33
34
MT. HOPE ROAD
LAKE ROAD
SEYMOUR ROAD
TRIST ROAD
water


27
N
R 2 E
(Joins sheet 18)
(Joins sheet 26)
(Joins sheet 36)
WATERLOO
RECREATION
AREA
W A T E R L O O
Waterloo
WASHTENAW COUNTY
Portage
River
water
SEYMOUR
ROAD
CLEAR
LAKE
26
25
35
36
5000 Feet

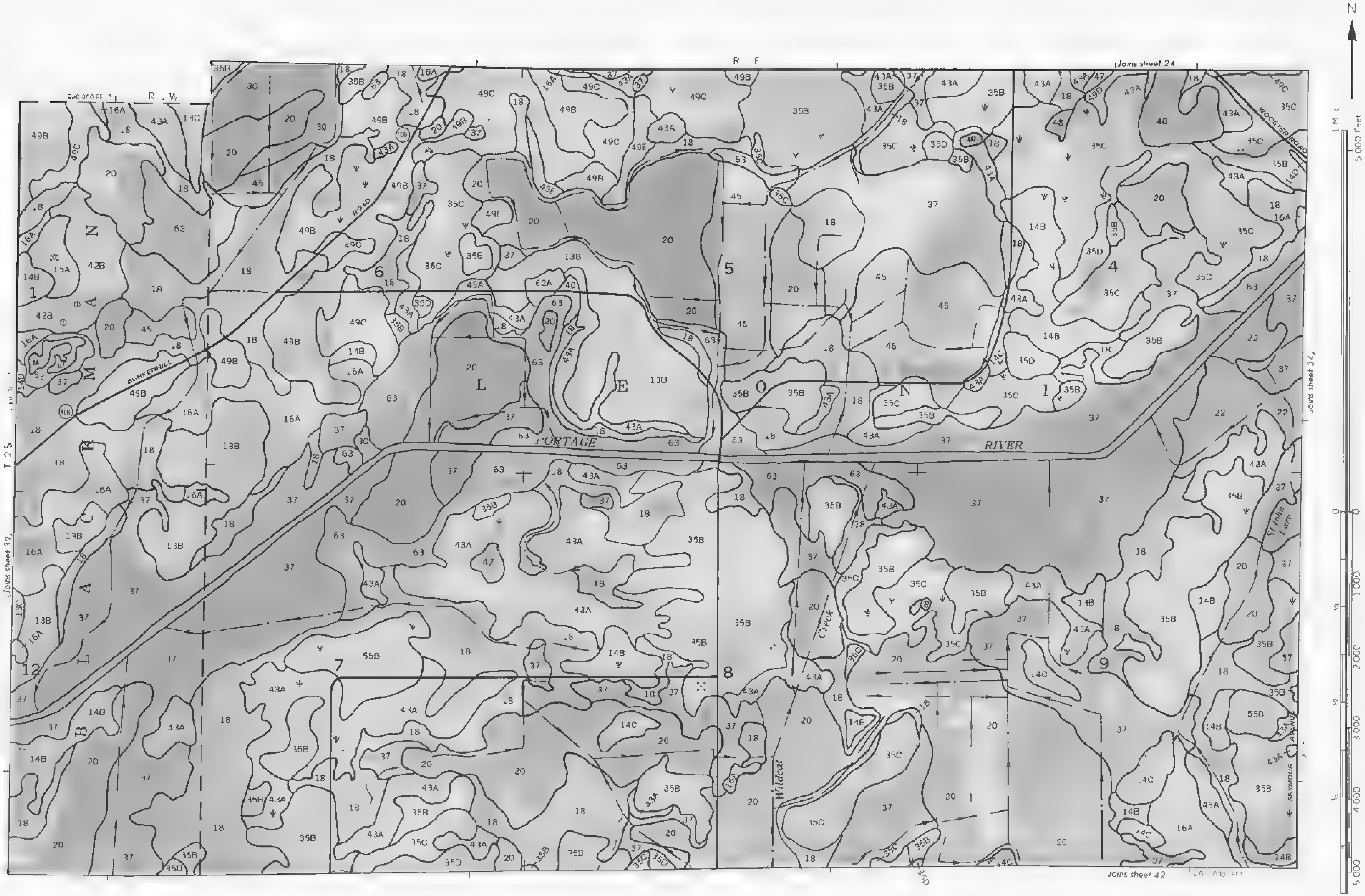

N
(Joins sheet 19)
(Joins sheet 37)
(Joins sheet 29)
R 3 W
T 2 S
CALHOUN COUNTY
Devereaux
DEVEREAUX ROAD
EATON RAPIDS ROAD
CRAWFORD ROAD
CALLAHAN ROAD
ROAD
Spring Brook
P A R M A
6
5
4
3
7
8
9
10
5 000 Feet
1 Mile
0
1000
2000
3000
4000
5000

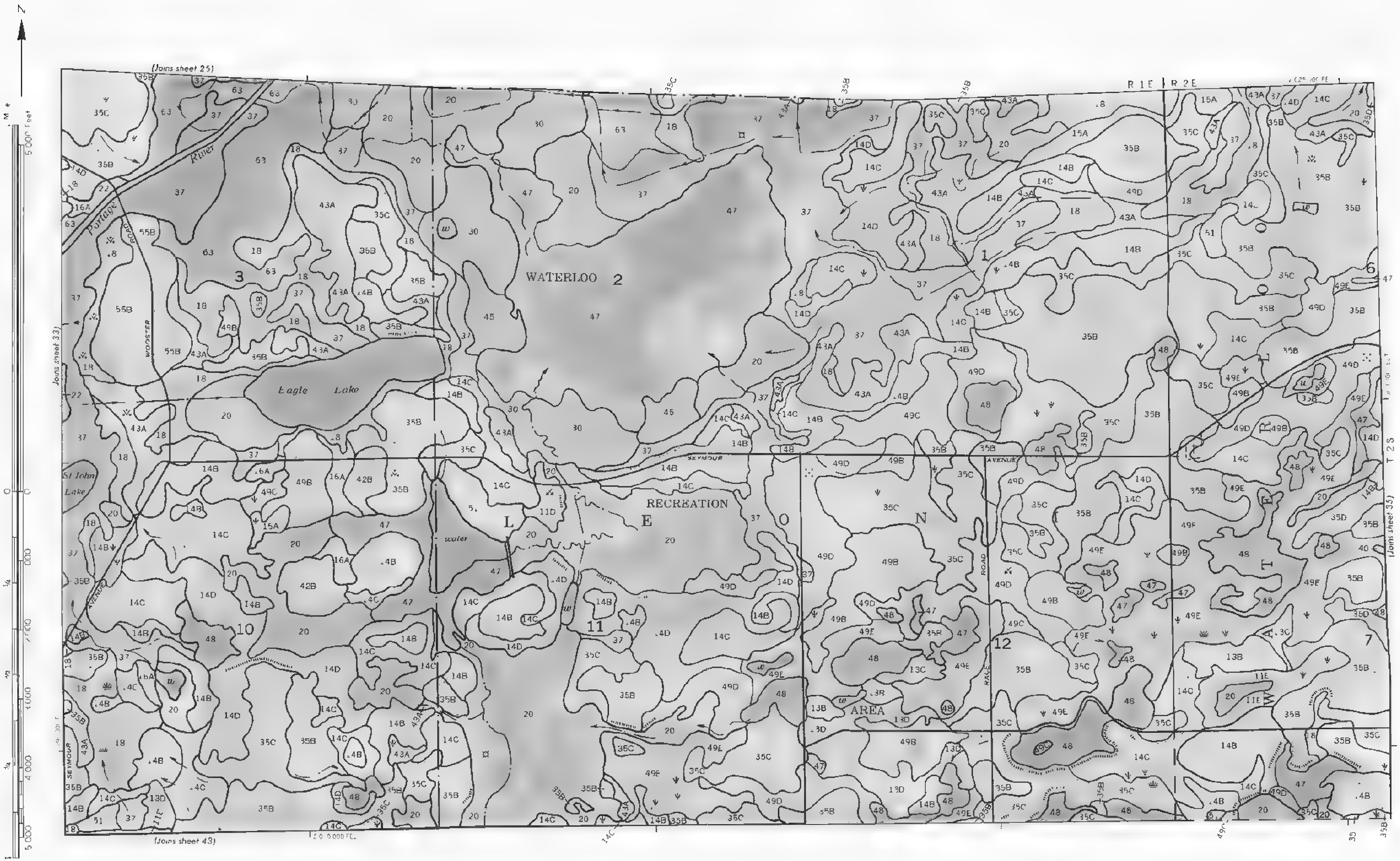

N
R 3 W
R 2 W
T 2 S
Joins sheet 20
(Joins sheet 28)
(Joins sheet 30)
(Joins sheet 38)
P A R M A
S A N D S T O N E
water
DEVEREAUX
ROAD
PARMA
ROAD
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000

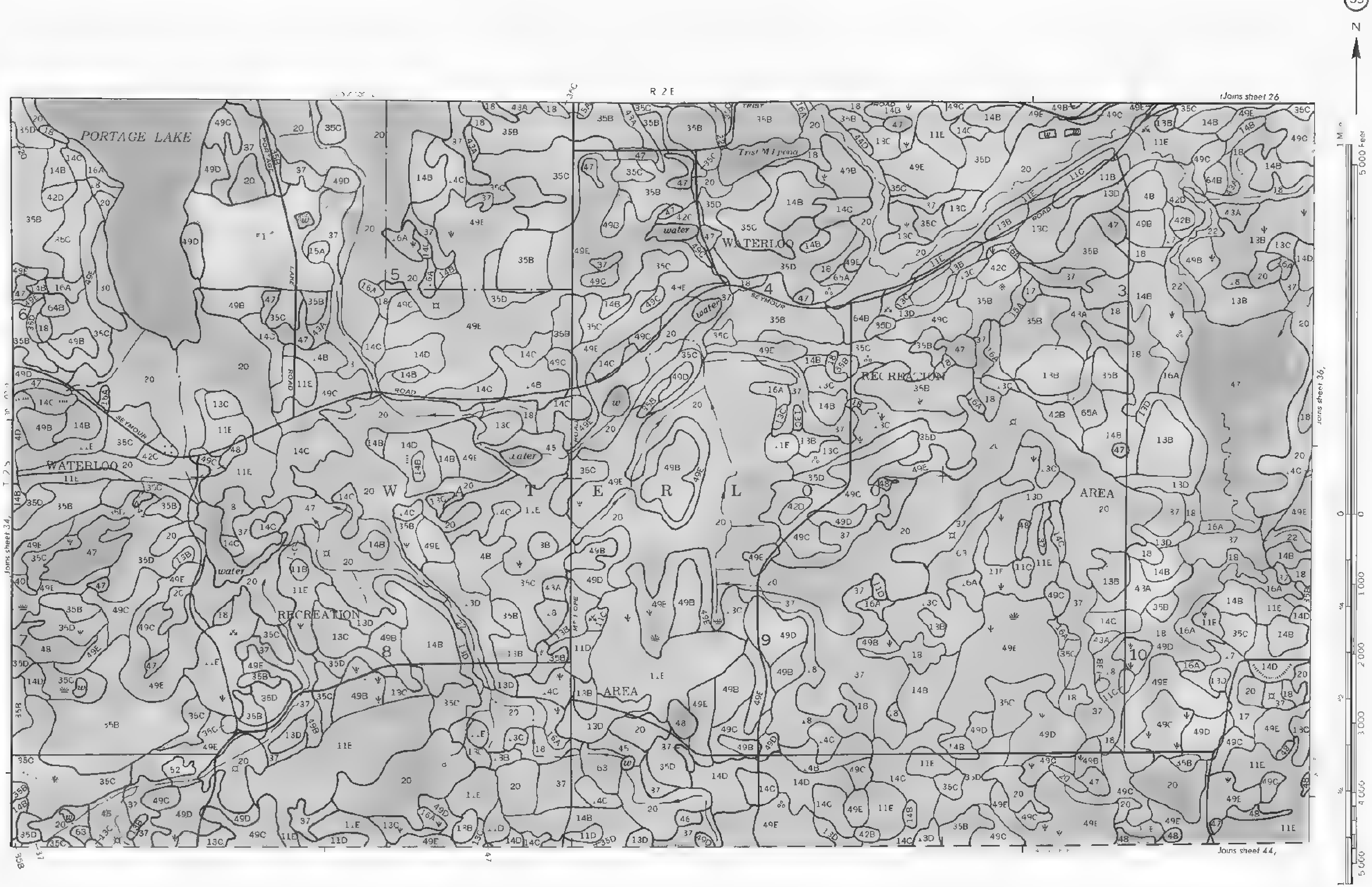

N
5 000 Feet
Joins sheet 2
R 2 W
Mirard Millpond
Creek
Sandstone
S A N D S T O N E
SPRINGPORT ROAD
DEARING ROAD
ROAD
North Lake
South Lake
(Joins sheet 29)
(Joins sheet 39)
(Joins sheet 31)

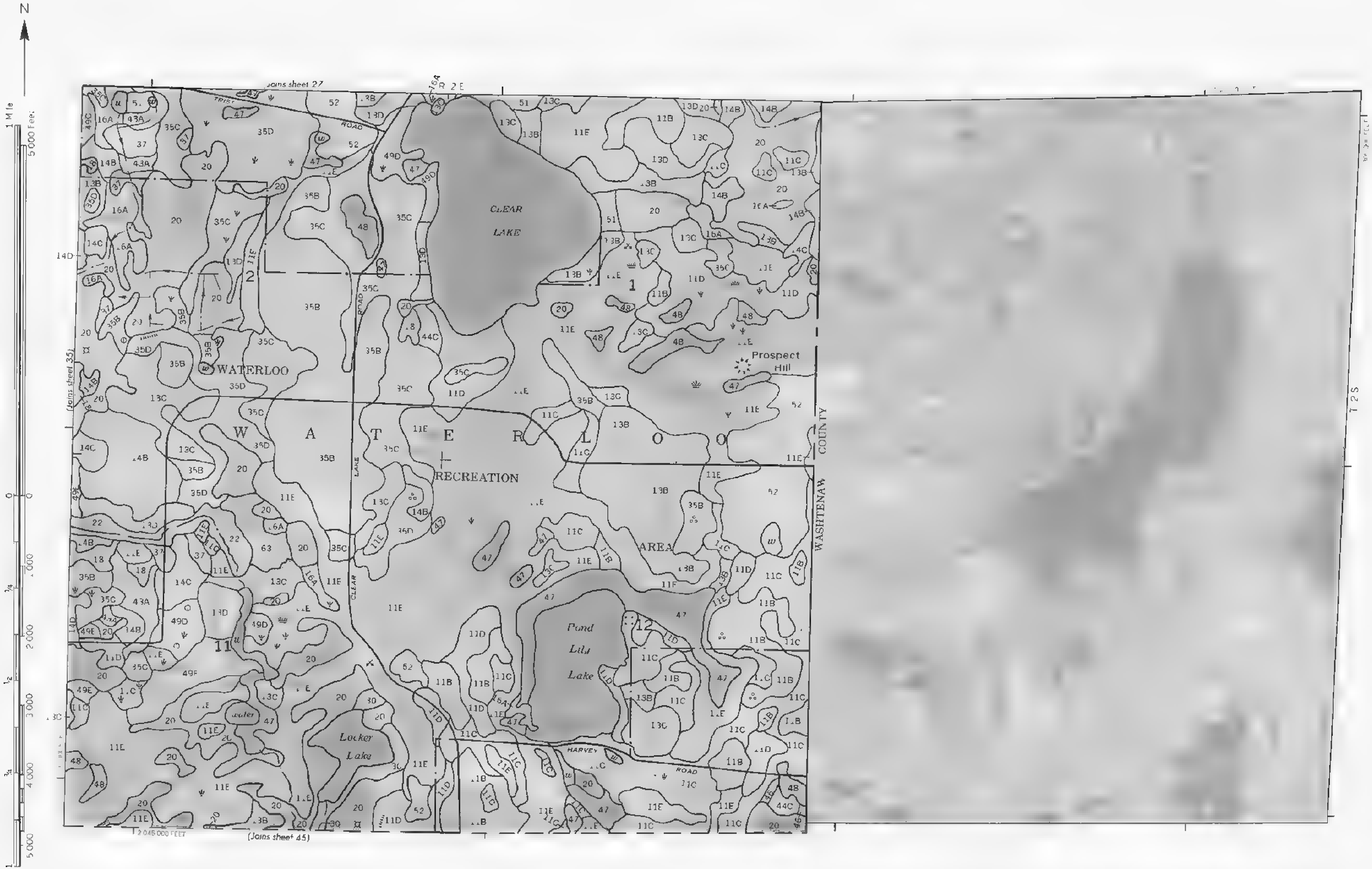

31
N
R 2 W
R 1 W
(Joins sheet 22)
(Joins sheet 30)
(Joins sheet 32)
(Joins sheet 40)
T 2 S
S A N D S T O N E
B L A C K M A N
CLINTON ROAD
ROAD
JUNCTION
water
North Lake
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1
1 000
2 000
3 000
4 000
5 000

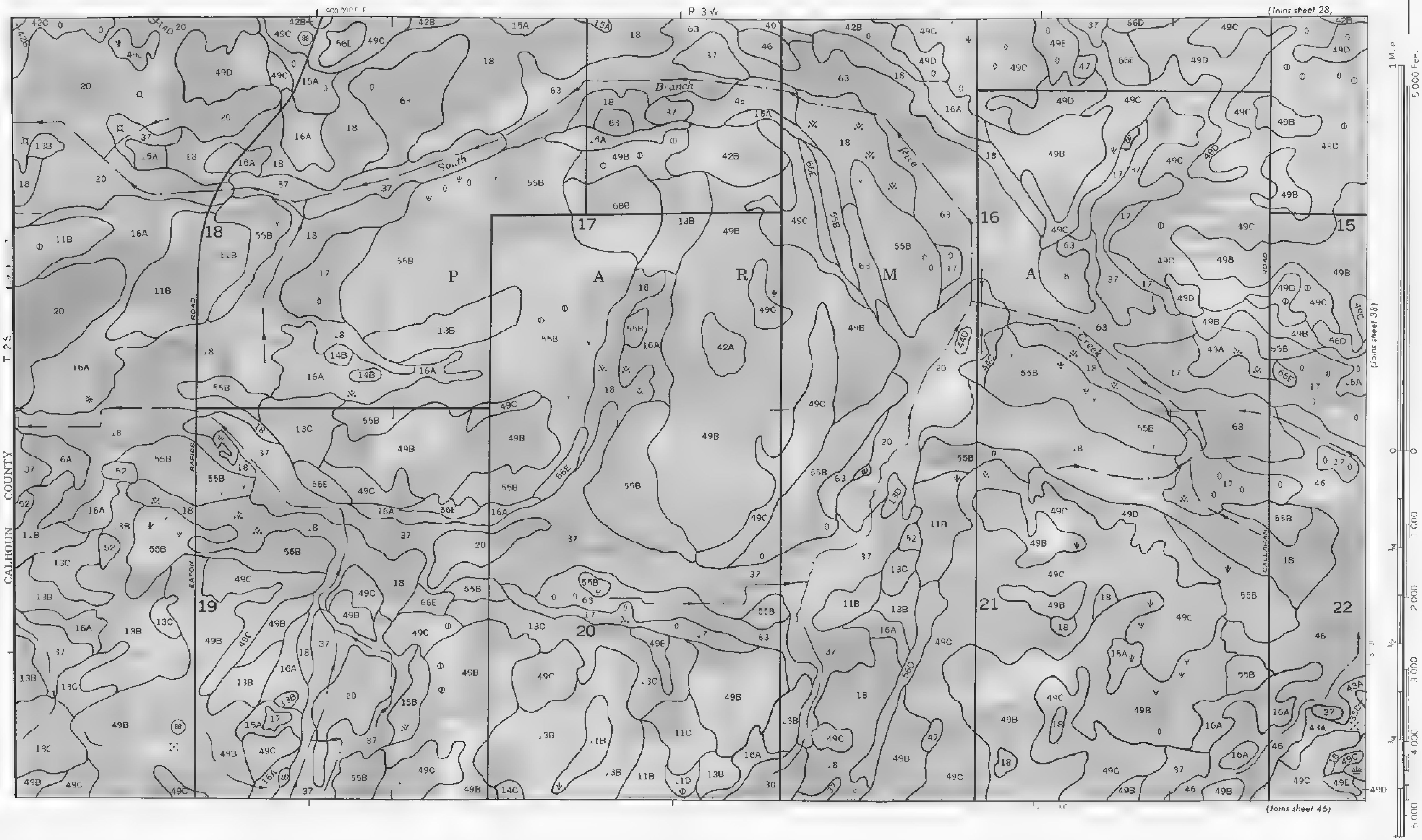

N
(Joins sheet 23)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 41)
R 1 W
T 2 S
B L A C K M A N
GRAND RIVER
RIVER
PORTAGE
LANSING AVENUE
COOPER STREET
BUNKERHILL ROAD
water
1 975 000 FEET
5 000 Feet
1 Mile

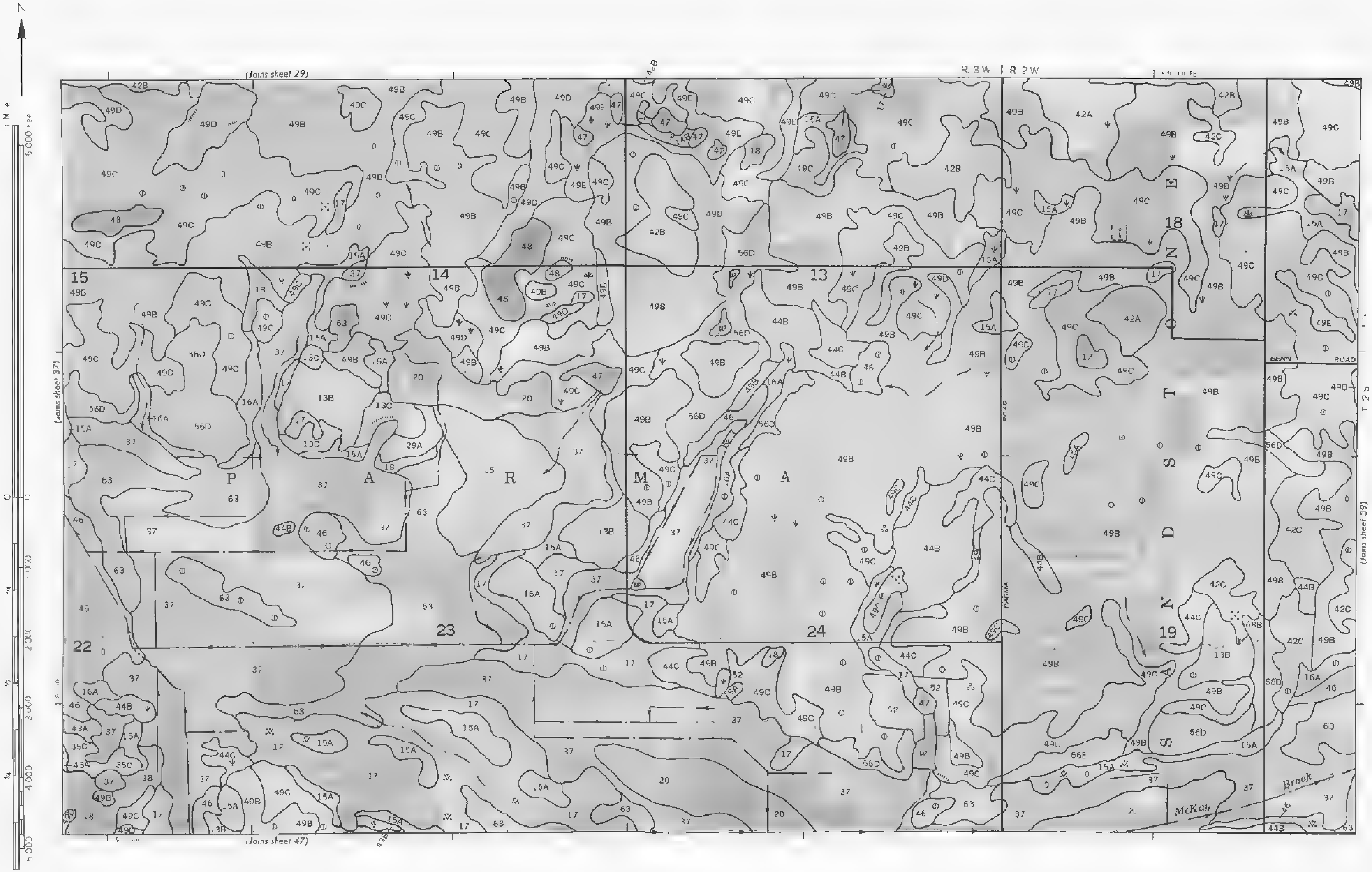

N
Joins sheet 24
Joins sheet 34
Joins sheet 42
Joins sheet 32
WOOSTER ROAD
BUNKERHILL ROAD
PORTAGE
RIVER
Wildcat
Creek
St John Lake
SEYMOUR ROAD
L
E
O
N
I
B
L
A
C
K
M
A
N
5000 Feet

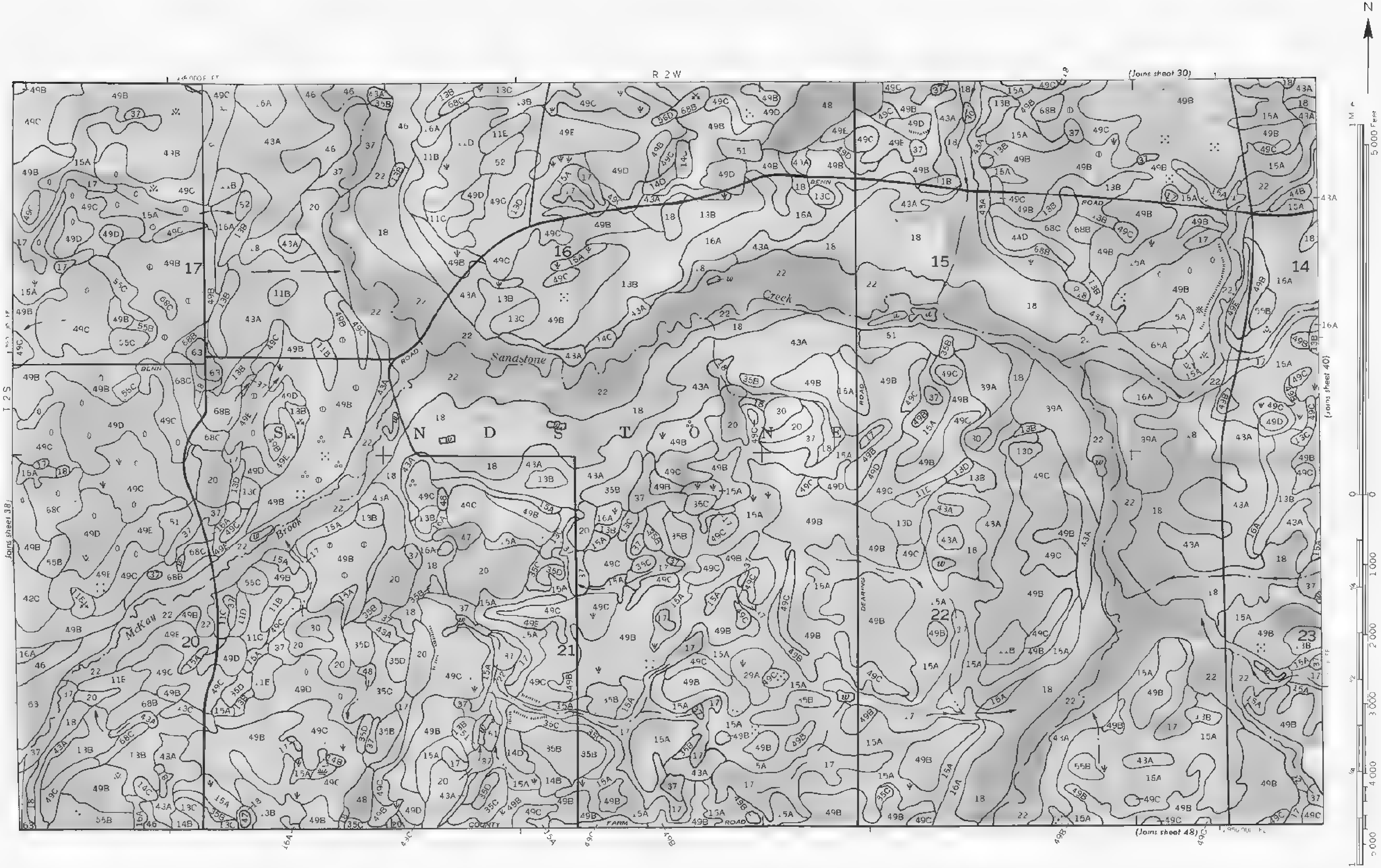

N
(Joins sheet 25)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 43)
R 1 E
R 2 E
T 2 S
Portage River
Eagle Lake
St John Lake
WATERLOO RECREATION AREA
SEYMOUR AVENUE
WOOSTER ROAD
RACE ROAD
water
5 000 Feet
0
1 Mile

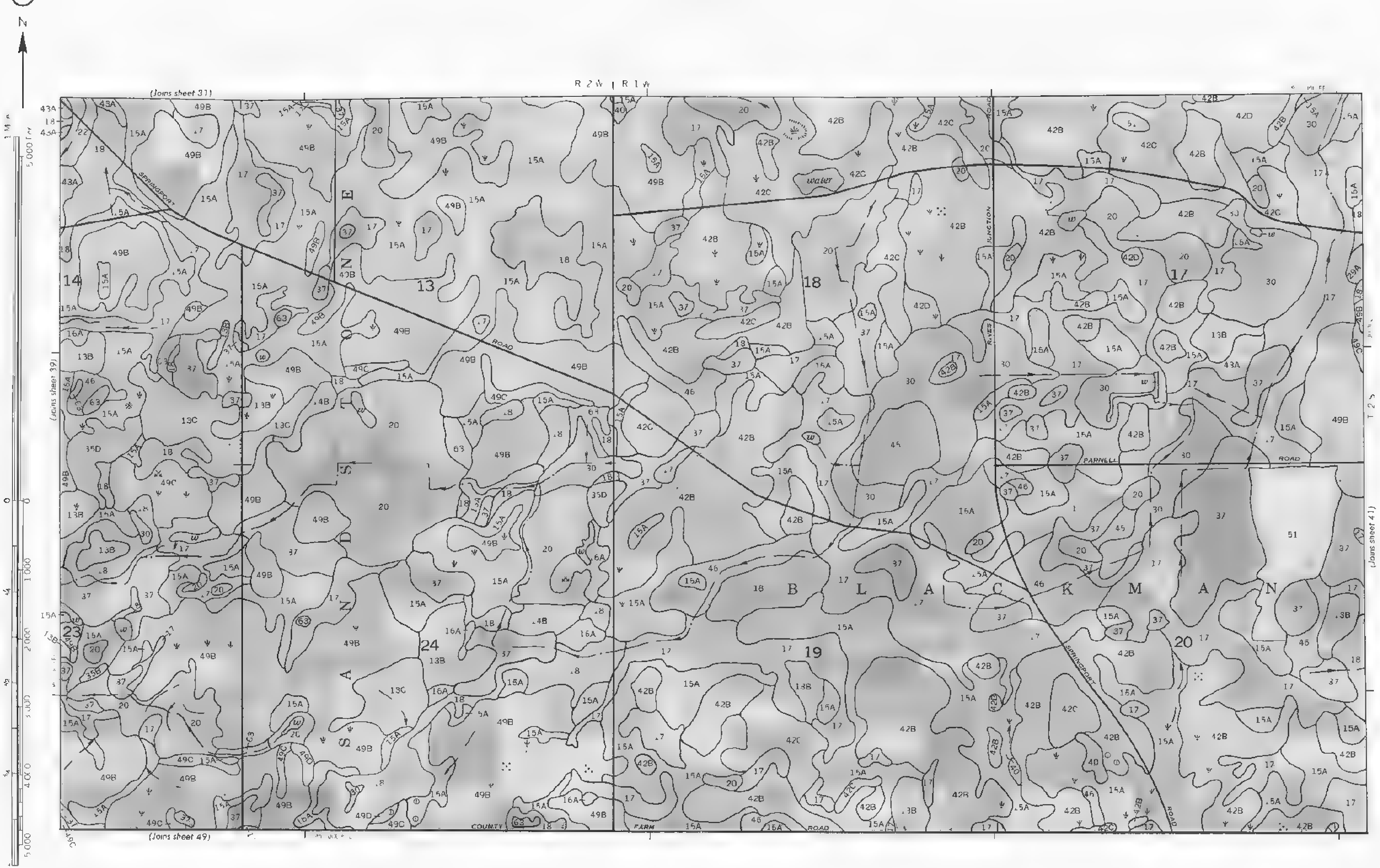

35
N
R 2 E
Joins sheet 26
Joins sheet 36
Joins sheet 44
Joins sheet 34
PORTAGE LAKE
WATERLOO
SEYMOUR
ROAD
Trist Mill pond
water
WATERLOO RECREATION AREA
RECREATION
AREA
1 Mile
5000 Feet

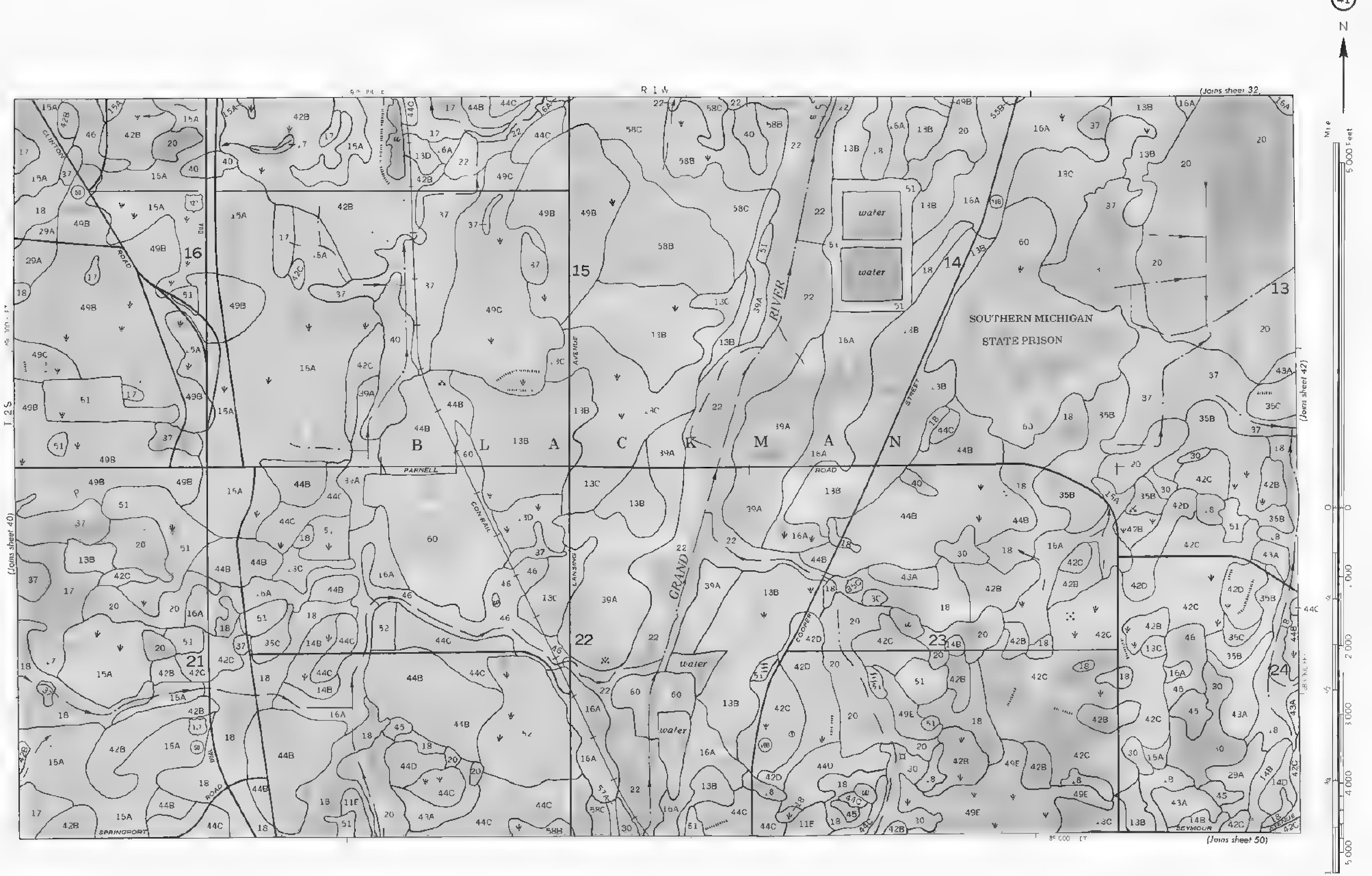

N
1 Mile
5 000 Feet
Joins sheet 27
Joins sheet 35
Joins sheet 45
CLEAR LAKE
WATERLOO
WATERLOO RECREATION AREA
Prospect Hill
Pond Lily Lake
Locker Lake
WASHTENAW COUNTY
TRIST ROAD
HARVEY ROAD
CLEAR LAKE ROAD
R 2 E
T 2 S
2 045 000 FEET

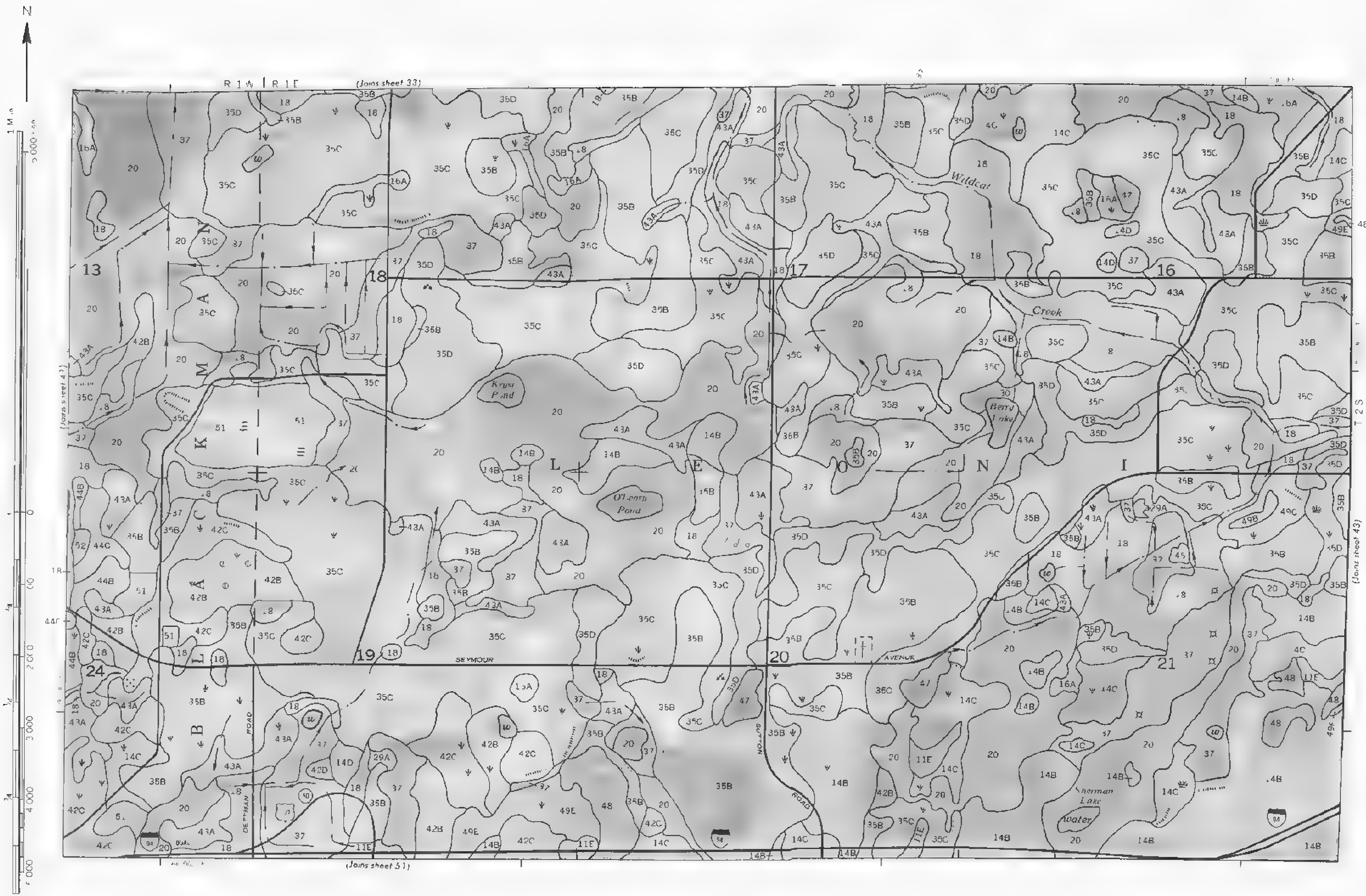

(Joins sheet 28)
(Joins sheet 38)
(Joins sheet 46)
R 3 W
T 2 S
CALHOUN COUNTY
P
A
R
M
A
South
Branch
Rice
Creek
EATON
RAPIDS
ROAD
CALLAHAN
ROAD
17
16
15
18
19
20
21
22
N
1 Mile
5 000 Feet

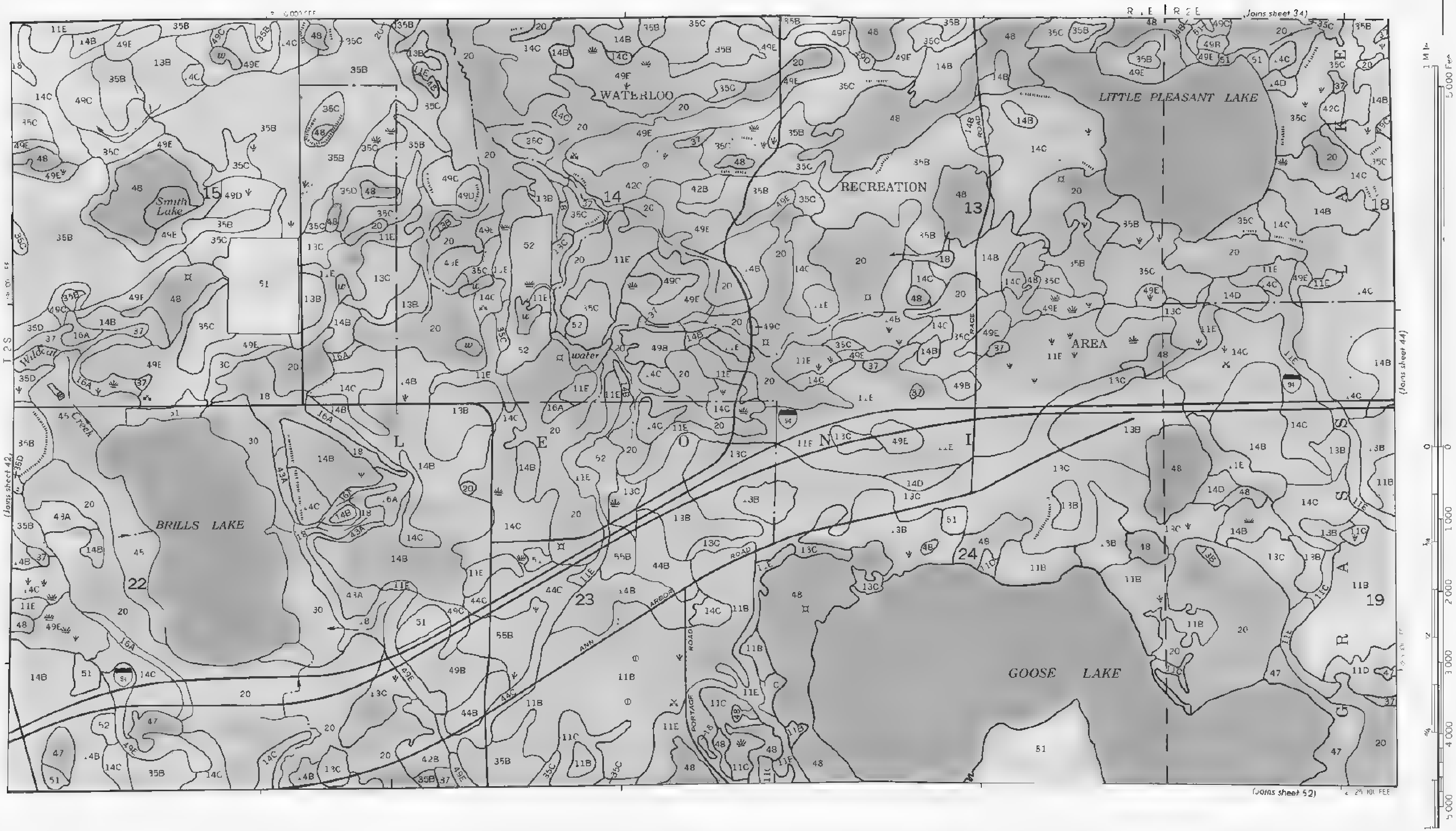

N
1 Mile
5 000 Feet
(Joins sheet 29)
(Joins sheet 47)
(Joins sheet 37)
(Joins sheet 39)
R 3 W
R 2 W
T 2 S
PARMA
SANDSTONE
BENN ROAD
McKay
Brook
15
14
13
18
22
23
24
19

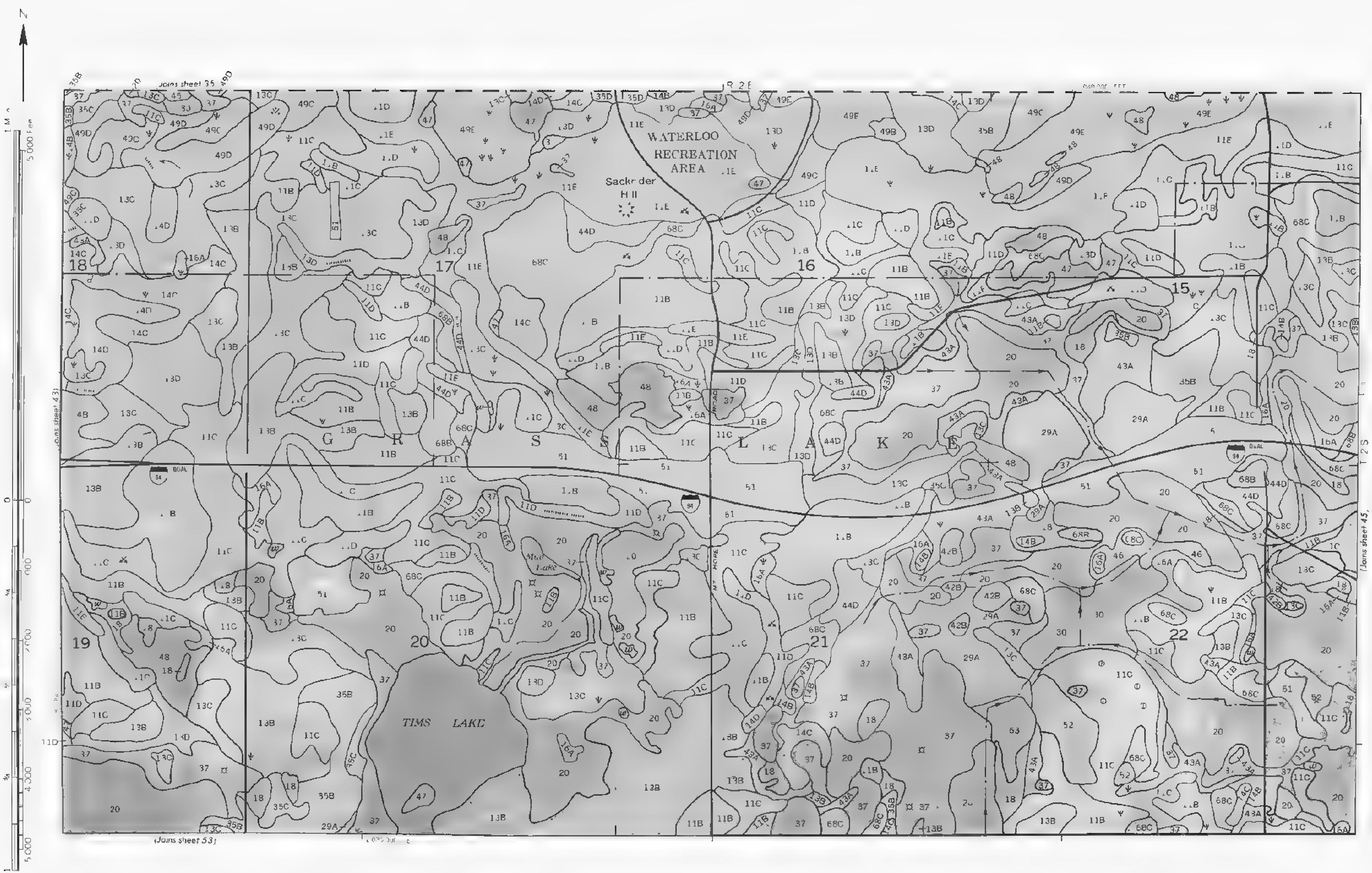

N
R 2 W
(Joins sheet 30)
(Joins sheet 48)
(Joins sheet 38)
(Joins sheet 40)
T 2 S
S A N D S T O N E
Sandstone
Creek
McKau
Brook
BENN ROAD
DEARING ROAD
COUNTY FARM ROAD
14
15
16
17
20
21
22
23
5 000 Feet
1 Mile


40
N
(Joins sheet 31)
(Joins sheet 49)
(Joins sheet 39)
(Joins sheet 41)
R 2 W | R 1 W
T 2 S
SANDSTONE
BLACKMAN
SPRINGPORT ROAD
JUNCTION ROAD
RIVES
PARNELL ROAD
COUNTY FARM ROAD
water
14
13
18
17
23
24
19
20


41
N
R 1 W
T 2 S
(Joins sheet 32)
(Joins sheet 40)
(Joins sheet 42)
(Joins sheet 50)
B L A C K M A N
SOUTHERN MICHIGAN
STATE PRISON
GRAND RIVER
water
CLINTON ROAD
PARNELL ROAD
CONRAIL
LANSING AVENUE
COOPER STREET
SPRINGPORT ROAD
SEYMOUR AVENUE
16
15
14
13
21
22
23
24
Mile
5 000 Feet


N
R 1 W
R 1 E
(Joins sheet 33)
(Joins sheet 51)
(Joins sheet 43)
(Joins sheet 41)
T 2 S
BLACKMAN
LEONI
13
18
17
16
24
19
20
21
Wildcat
Creek
Kryst Pond
O'Leary Pond
Berry Lake
Sherman Lake
water
SEYMOUR
AVENUE
ROAD


(Joins sheet 34)
(Joins sheet 44)
(Joins sheet 42)
(Joins sheet 52)
WATERLOO
RECREATION
AREA
LITTLE PLEASANT LAKE
Smith Lake
BRILLS LAKE
GOOSE LAKE
Wildcat
Creek
L E O N I
ANN ARBOR ROAD
PORTAGE ROAD
RANGE ROAD
T 2 S
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000

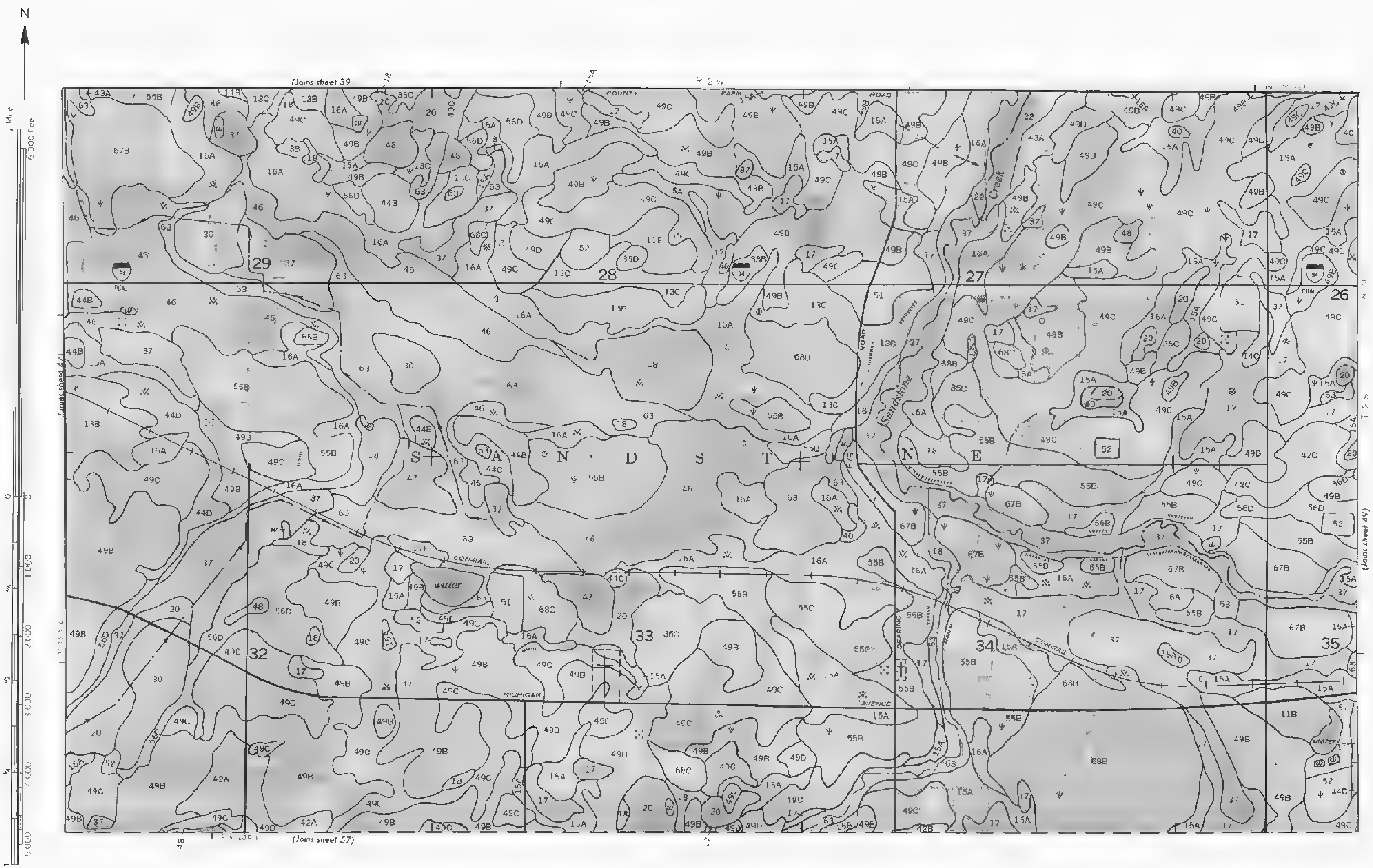

N
(Joins sheet 35)
R 2 E
WATERLOO RECREATION AREA
Sackrider Hill
18
17
16
15
19
20
21
22
G R A S S L A K E
(Joins sheet 43)
(Joins sheet 45)
T 2 S
Mud Lake
TIMS LAKE
(Joins sheet 53)
94
5 000 Feet
1 Mile

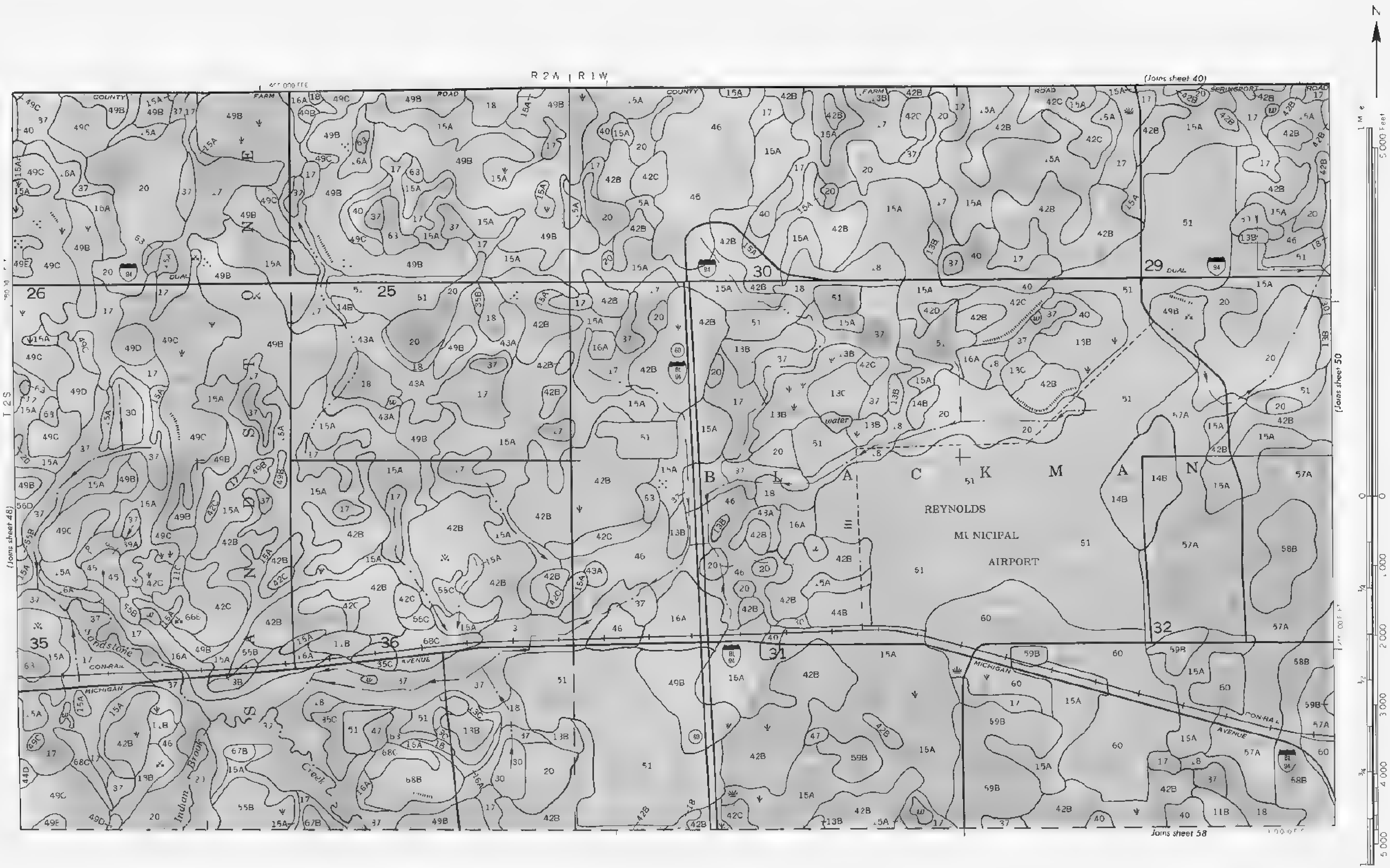
45
N
R 2 E.
Joins sheet 36
Joins sheet 44
Joins sheet 54
WATERLOO
RECREATION
AREA
GRASS LAKE
WASHTENAW COUNTY
Notten Lake
CLEAR LAKE ROAD
FRANCISCO
T 2 S.
14
13
23
24
1 Mile
5 000 Feet


46
N
(Joins sheet 37)
(Joins sheet 55)
(Joins sheet 47)
R 3 W
T 2 S
ALBION COUNTY
MICHIGAN
AVENUE
ROAD
RAPIDS
EATON
CALLAHAN
CONCORD
NORTH
ERIE
ROAD
DUAL
P A R M A
27
28
29
30
31
32
33
34


47
N
R 3 W
R 2 W
(Joins sheet 38)
(Joins sheet 46)
(Joins sheet 48)
(Joins sheet 56)
MICHIGAN
AVENUE
COUNTY FARM ROAD
CONCORD ROAD
PARMA ROAD
ERIE ROAD
CONRAIL
McKay Brook
South Branch Rice Creek
Parma
P A R M A
S A N D S T O N E
26
25
27
30
34
35
36
31
5 000 Feet

JACKSON COUNTY, MICHIGAN — SHEET NUMBER 48




R 2 W | R 1 W
(Joins sheet 40)
(Joins sheet 48)
(Joins sheet 50)
Joins sheet 58
T 2 S
26
25
30
29
35
36
31
32
BLACKMAN
REYNOLDS
MUNICIPAL
AIRPORT
MICHIGAN
AVENUE
CON-RAIL
COUNTY
FARM
ROAD
SPRINGPORT
DUAL
Sandstone
Indian
Brook
Creek
water
N
1 Mile
5000 Feet

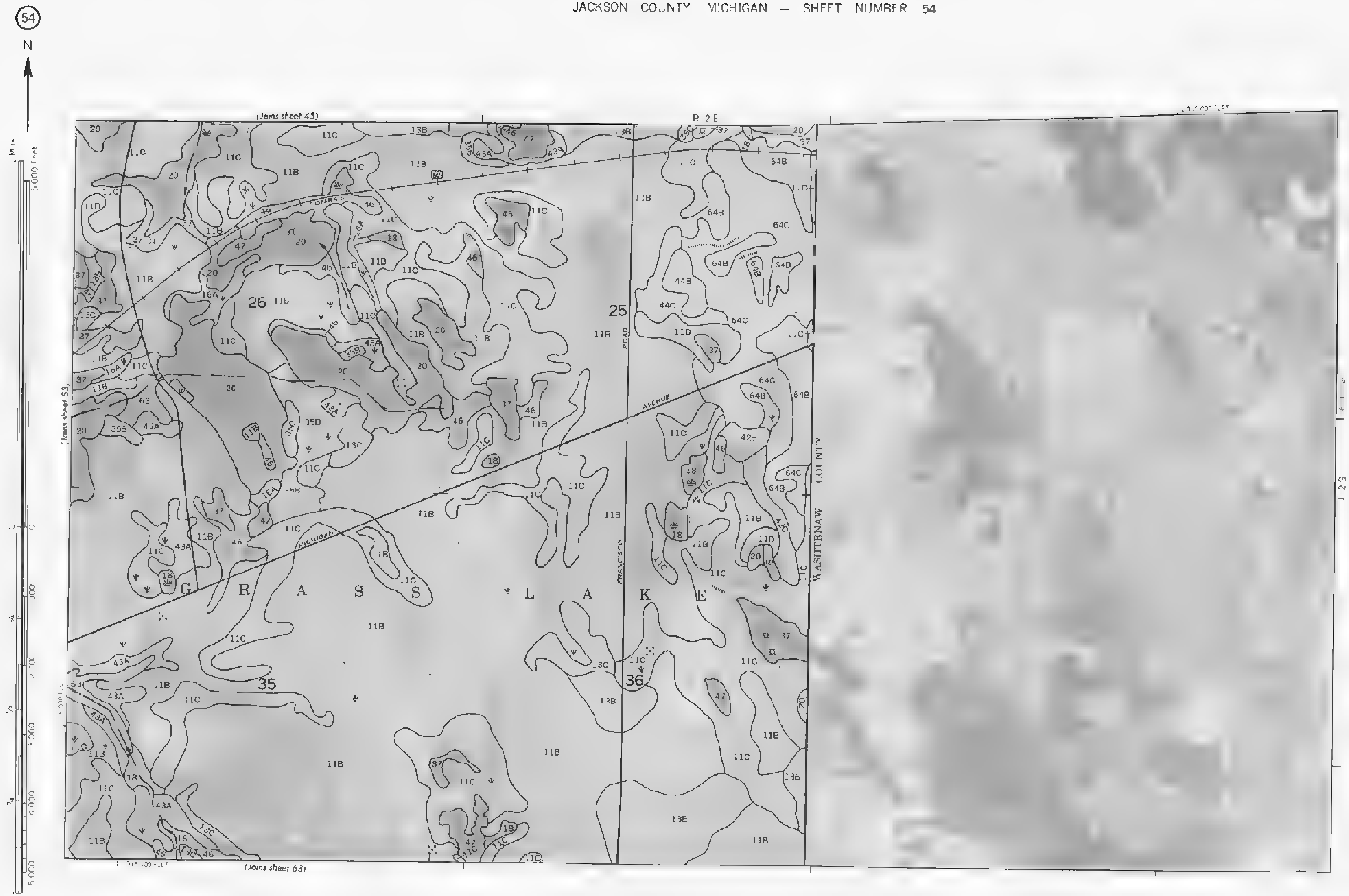

N
1 Mile
5 000 Feet
(Joins sheet 41)
(Joins sheet 49)
(Joins sheet 51)
(Joins sheet 59)
R 1 W
T 2 S
BLACKMAN
JACKSON
(county seat)
GRAND RIVER
CEMETERY
LOOMIS PARK
LANSING AVENUE
BROWN STREET
WEST AVENUE
COOPER STREET
SOUTH JACKSON ROAD
GANSON STREET
MICHIGAN AVENUE
CON-RAIL
SEYMOUR AVENUE
28
27
26
25
33
34
35
36

51


N
(Joins sheet 42)
(Joins sheet 52)
(Joins sheet 60)
(Joins sheet 50)
R 1 W
R 1 E
T 2 S
GILLETTS
LAKE
CEMETERY
GANSON STREET
MICHIGAN AVENUE
ANN ARBOR ROAD
SUTTON ROAD
DETTMAN ROAD
B L A C K M A N
L E O N I
25
30
29
28
36
31
32
33
1 Mile
5 000 Feet


N
(Joins sheet 43)
(Joins sheet 51)
(Joins sheet 53)
Joins sheet 61
GOOSE LAKE
GILLETTS LAKE
MICHIGAN AVENUE
PORTAGE ROAD
CONRAIL
R 1 E
R 2 E
T 2 S
25
26
27
30
31
34
35
36
water


53
N
(Joins sheet 44)
(Joins sheet 54)
(Joins sheet 62)
(Joins sheet 52)
R. 2 E.
T. 2 S.
2 030 000 FEET
TIMS LAKE
GRASS LAKE
GRASS LAKE
Grass Lake
Rowe Lake
MICHIGAN AVENUE
CONRAIL
GRASS LAKE ROAD
MT. HOPE ROAD
28
29
30
31
32
33
34
27
5 000 Feet
0
1000
2000
3000
4000
5000

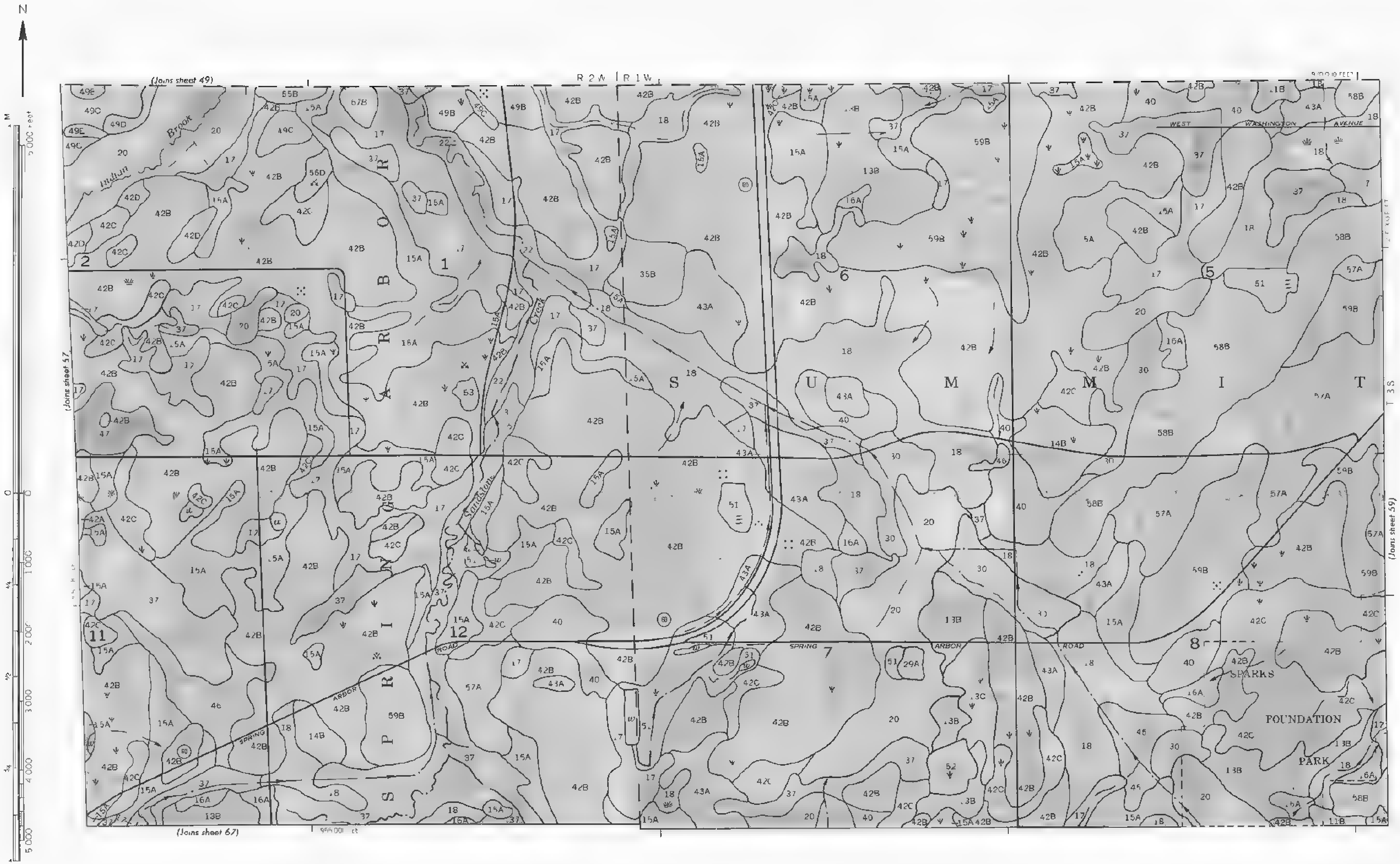


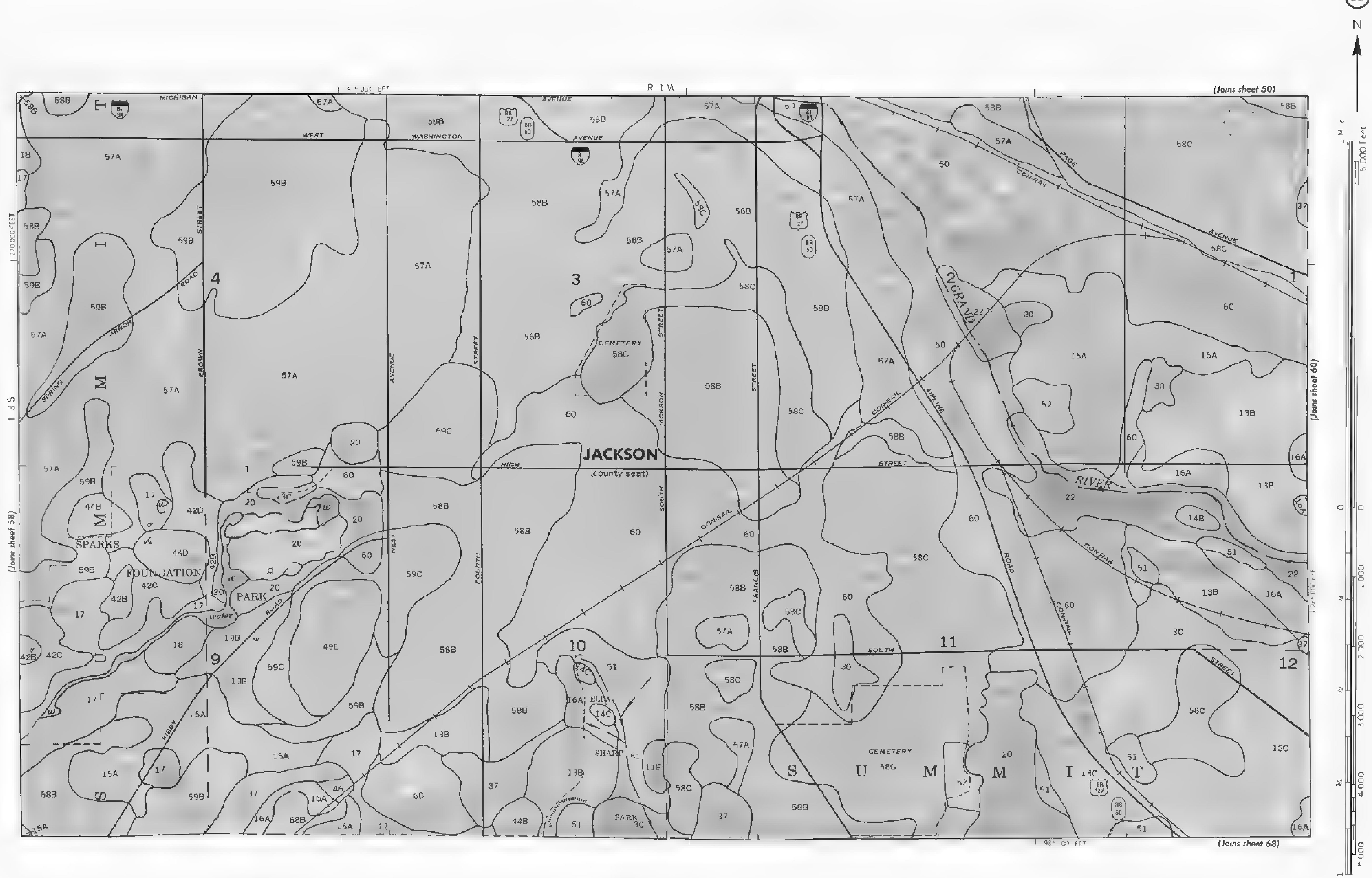
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

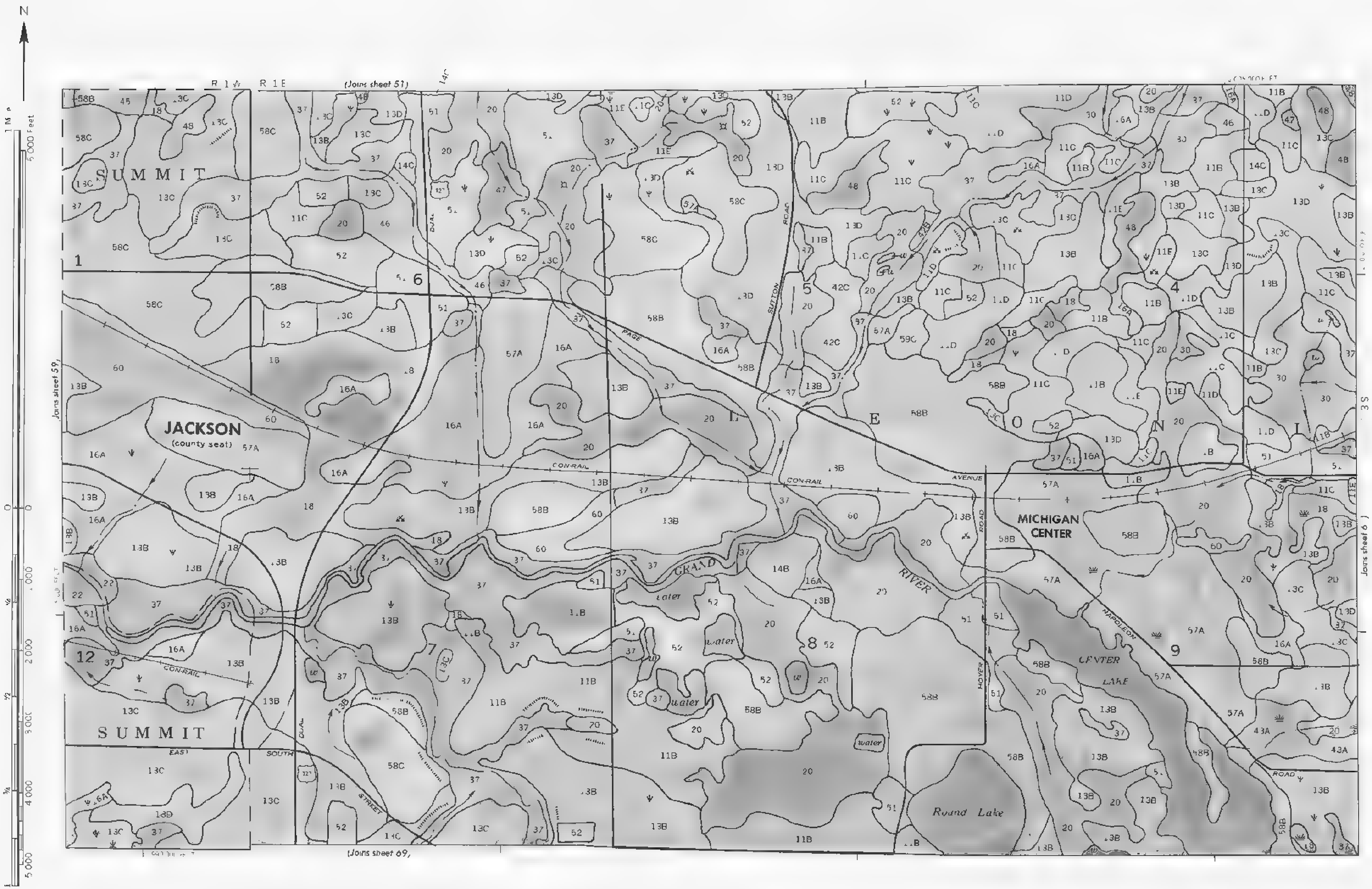

N
R 3 W
(Joins sheet 46)
(Joins sheet 56)
(Joins sheet 64)
T 3 S
CALHOUN COUNTY
CONCORD
NORTH
North Branch
Kalamazoo River
CONRAIL
ALBION
ERIE
VAN WERT
KING ROAD
CALHOUN ROAD
0
1,000
2,000
3,000
4,000
5,000 Feet

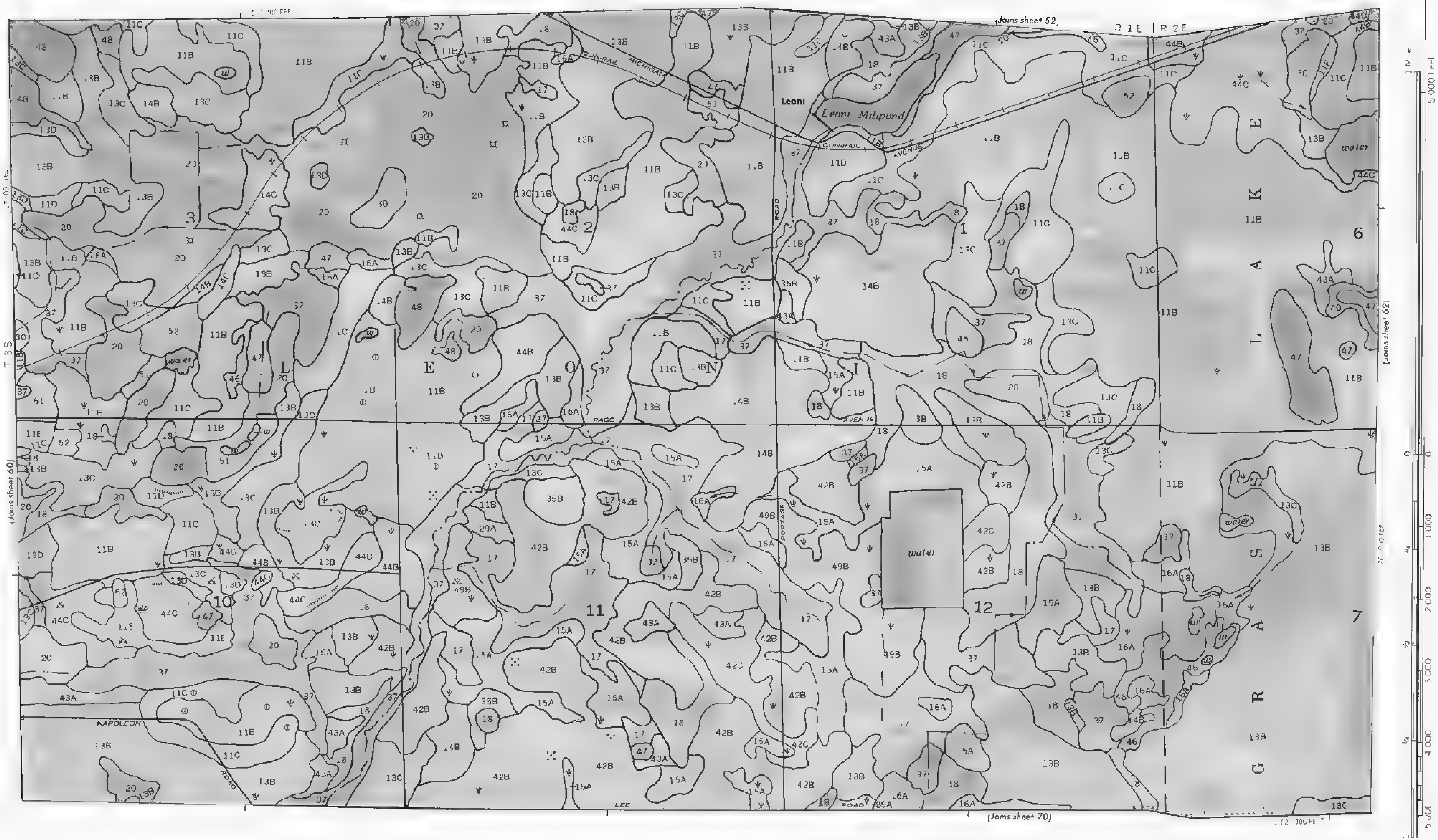

(Joins sheet 47)
(Joins sheet 55)
(Joins sheet 57)
(Joins sheet 65)
R. 3 W.
R. 2 W.
T. 3 S.
water
5 000 Feet
CONCORD
NORTH CONCORD ROAD
PARMA ROAD
KING ROAD
ERIE ROAD

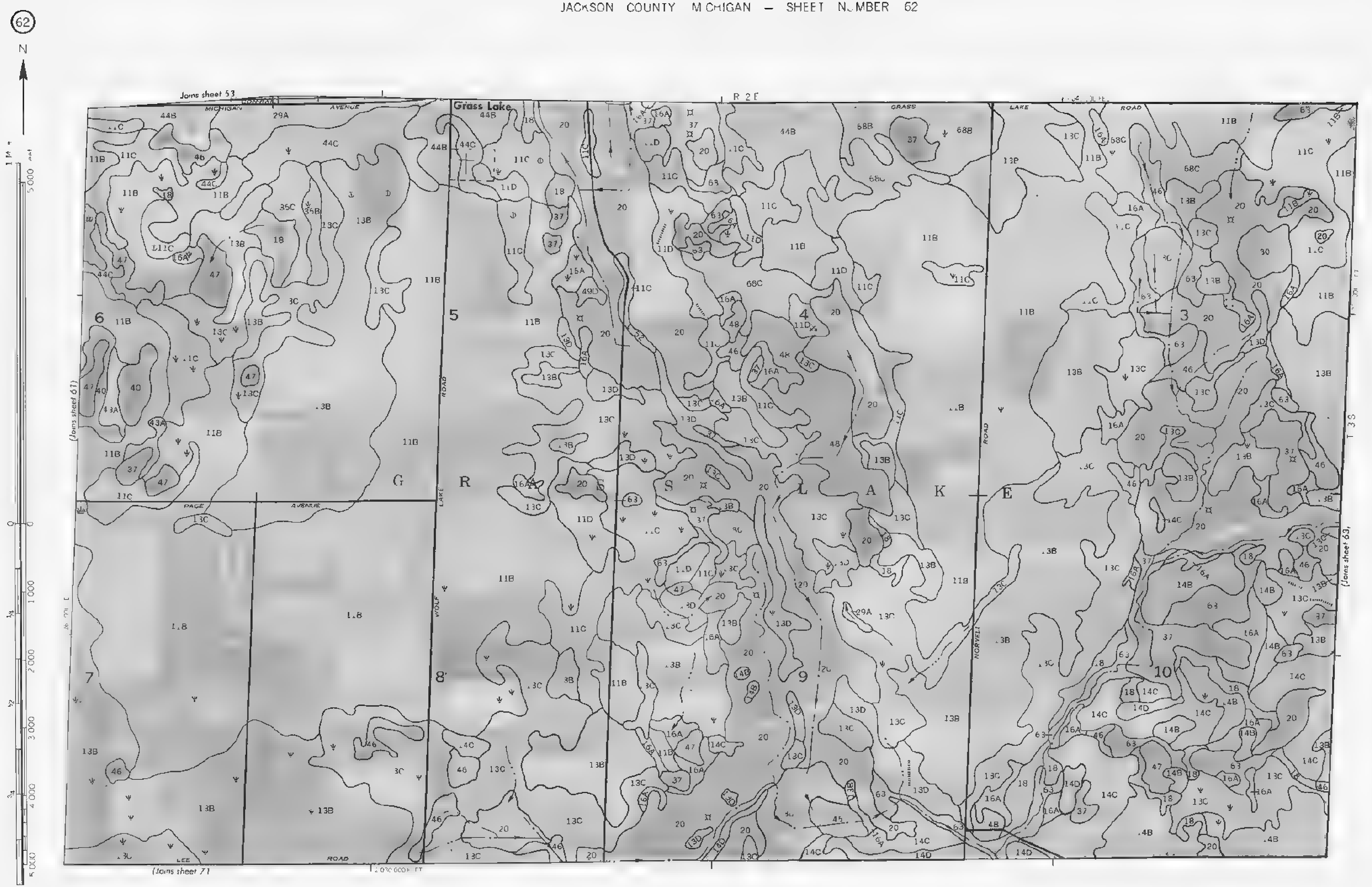

R 2 W
(Joins sheet 48)
(Joins sheet 58)
(Joins sheet 66)
(Joins sheet 56)
S P R I N G A R B O R
Indian Brook
DEARING ROAD
KING ROAD
N
1 Mile
5 000 Feet

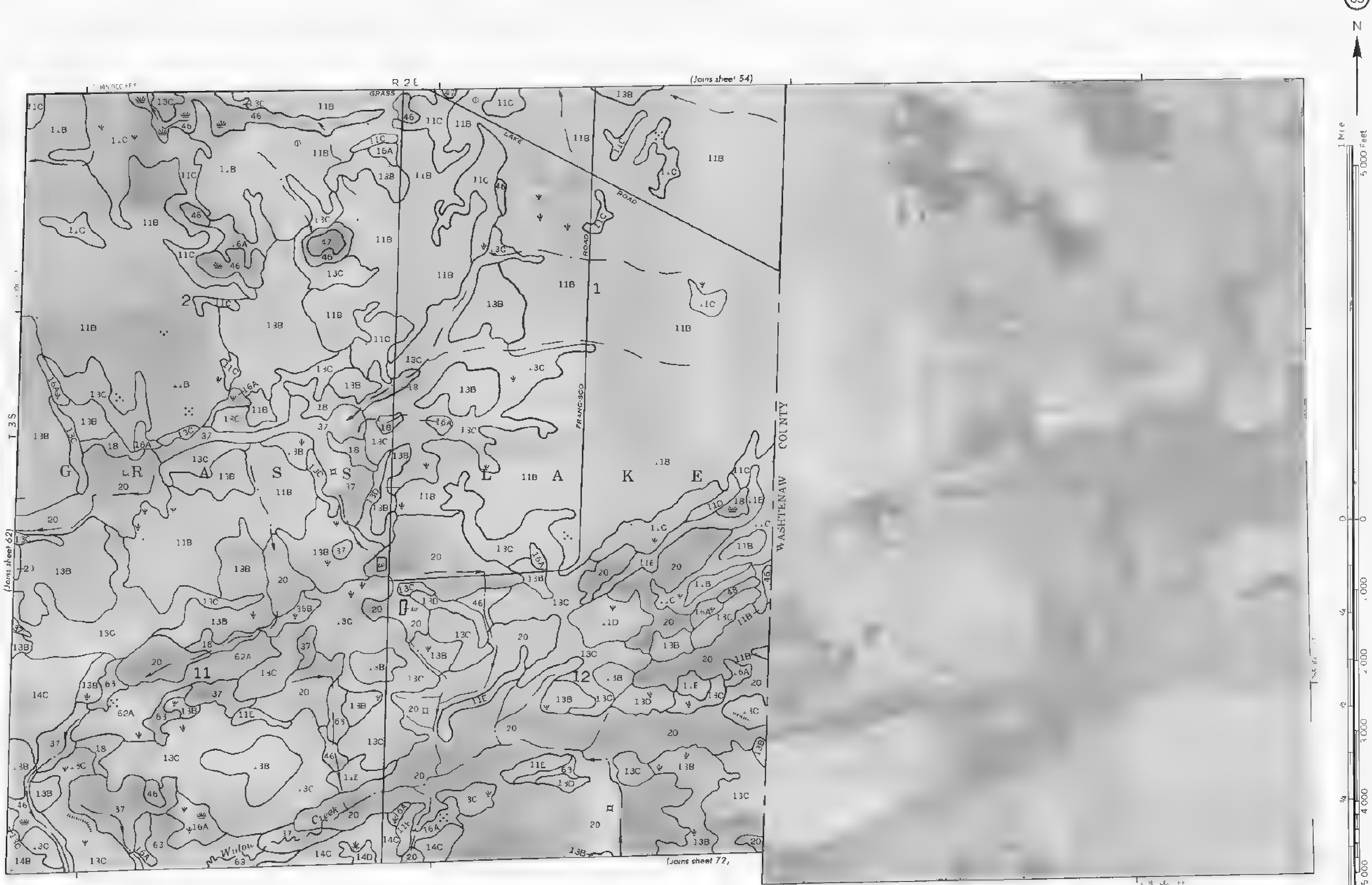

N
(Joins sheet 49)
R 2 W
R 1 W
(Joins sheet 57)
(Joins sheet 59)
(Joins sheet 67)
T 3 S
WEST WASHINGTON AVENUE
SPRING ARBOR ROAD
SPRING ARBOR
SUMMIT
Indian Brook
Sandstone Creek
SPARKS FOUNDATION PARK
1
2
5
6
7
8
11
12
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000


59
N
R 1 W
T 3 S
(Joins sheet 50)
(Joins sheet 60)
(Joins sheet 68)
(Joins sheet 58)
JACKSON
(county seat)
MICHIGAN
AVENUE
WEST
WASHINGTON
SPRING
ARBOR
ROAD
BROWN
STREET
WEST
AVENUE
FOURTH
STREET
HIGH
SOUTH
JACKSON
STREET
FRANCIS
STREET
PAGE
AVENUE
CON-RAIL
GRAND
RIVER
AIRLINE
ROAD
SOUTH
STREET
KIBBY
ROAD
CEMETERY
SPARKS
FOUNDATION
PARK
water
ELLA
SHARP
PARK
S U M M I T
T I M
S U
1
2
3
4
9
10
11
12
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000

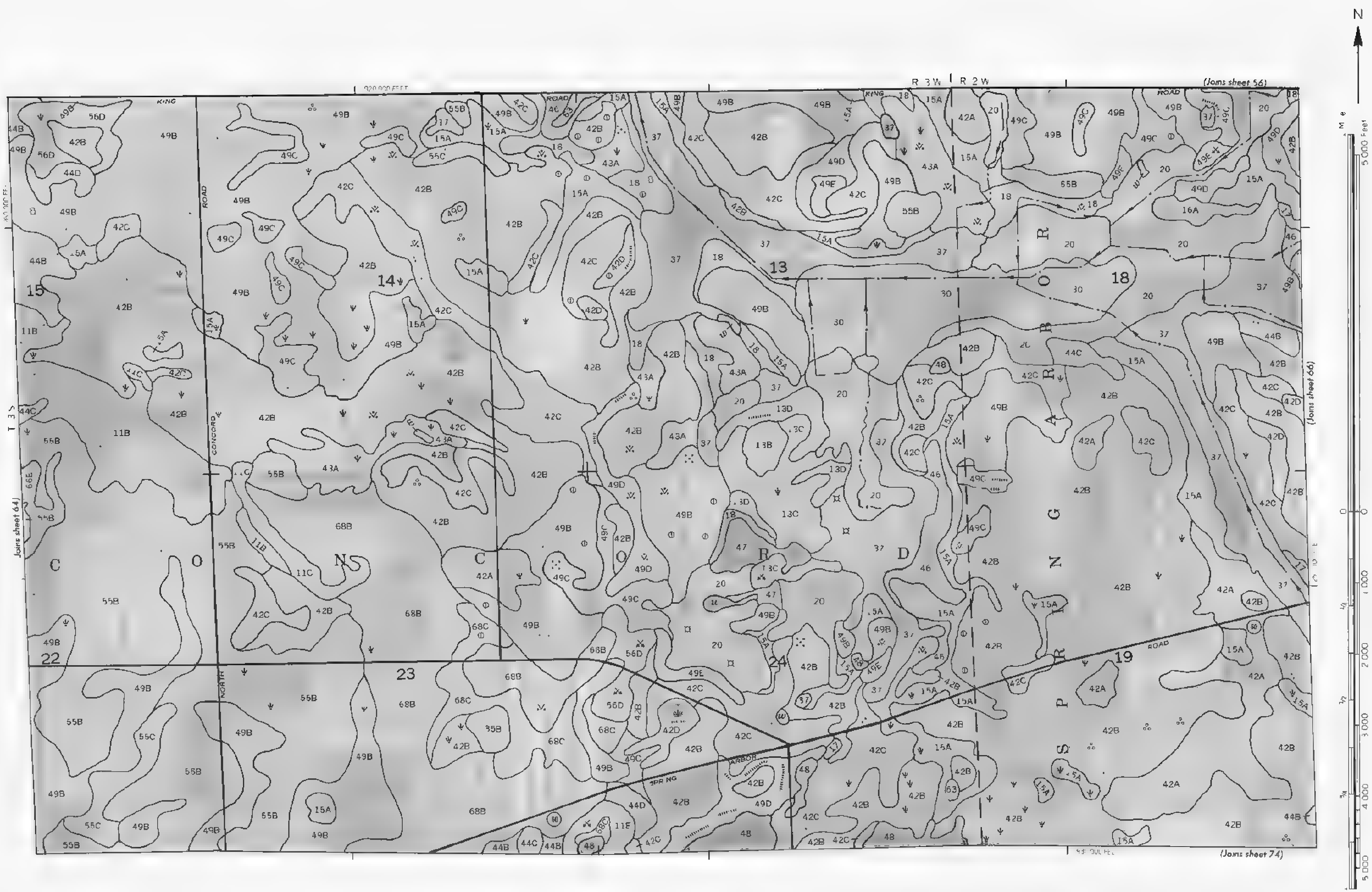

N
R 1 W
R 1 E
(Joins sheet 51)
(Joins sheet 69)
Joins sheet 59
Joins sheet 61
SUMMIT
JACKSON
(county seat)
MICHIGAN
CENTER
L E O N I
GRAND
RIVER
CENTER
LAKE
Round Lake
PAGE
AVENUE
NAPOLEON
ROAD
CON-RAIL
SUTTON
HOYER
ROAD
EAST
SOUTH
STREET
DUAL
5 000 Feet

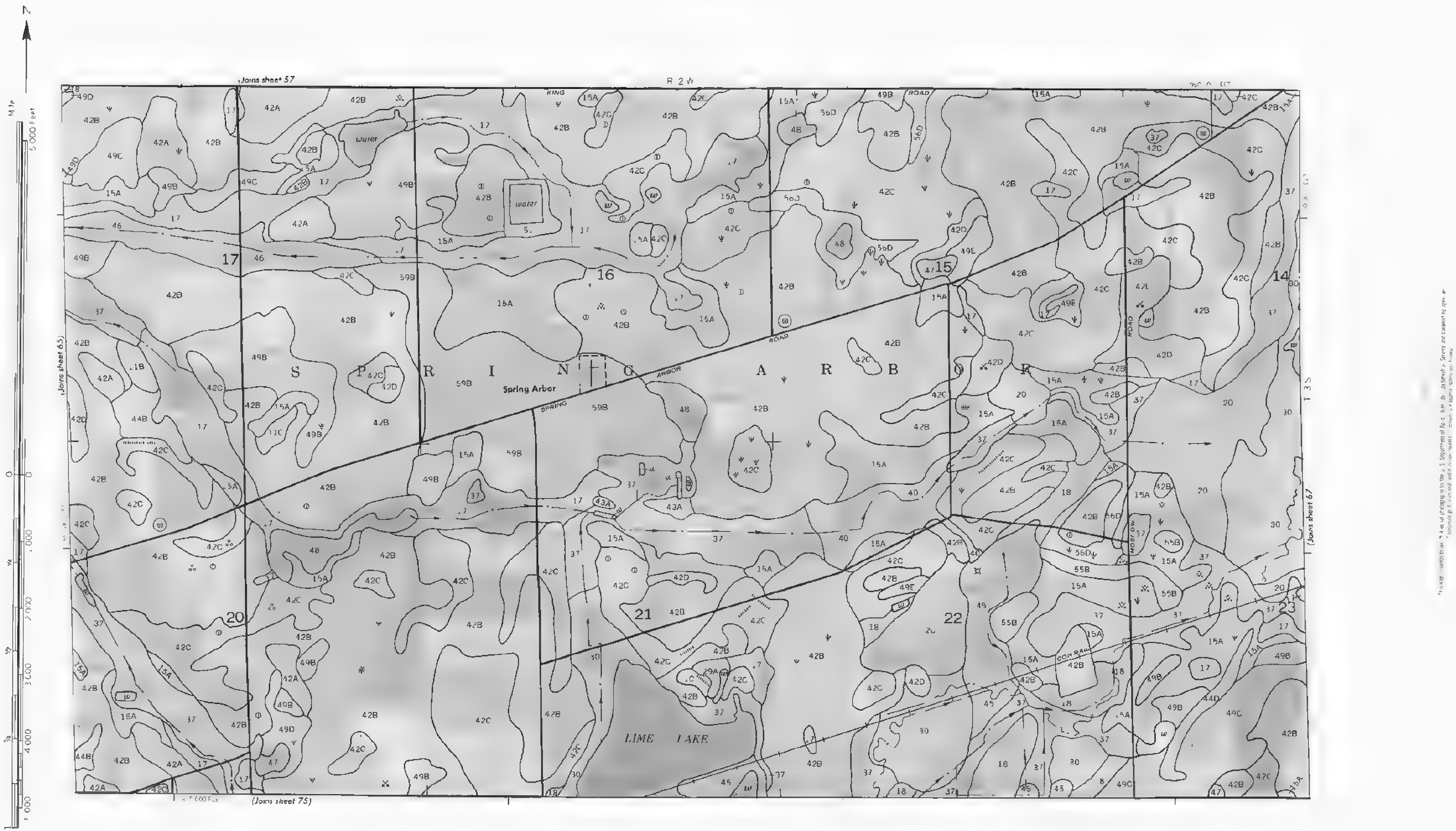

N
(Joins sheet 52)
(Joins sheet 60)
(Joins sheet 62)
(Joins sheet 70)
R 1 E
R 2 E
T 3 S
Leoni
Leoni Millpond
CON-RAIL
MICHIGAN
AVENUE
ROAD
PAGE
PORTAGE
NAPOLEON
LEE
LEONI
GRASS LAKE
water
5 000 Feet

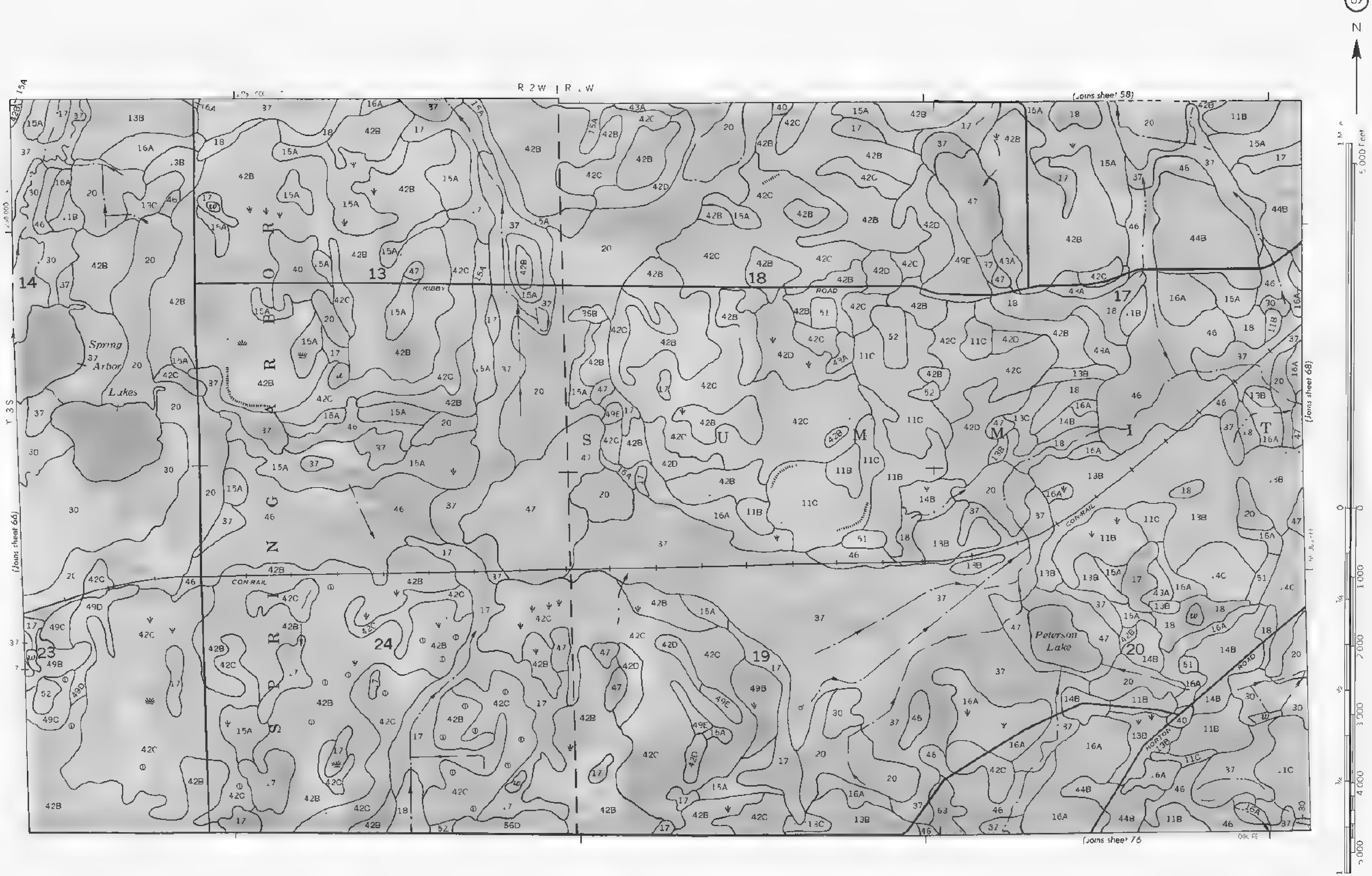

62
N
(Joins sheet 53)
Grass Lake
R 2 E
MICHIGAN AVENUE
GRASS LAKE ROAD
WOLF LAKE ROAD
NORVELL ROAD
PAGE AVENUE
LEE ROAD
(Joins sheet 61)
(Joins sheet 63)
(Joins sheet 71)
T 3 S
G R A S S L A K E
5
4
3
6
7
8
9
10
Grass Lake

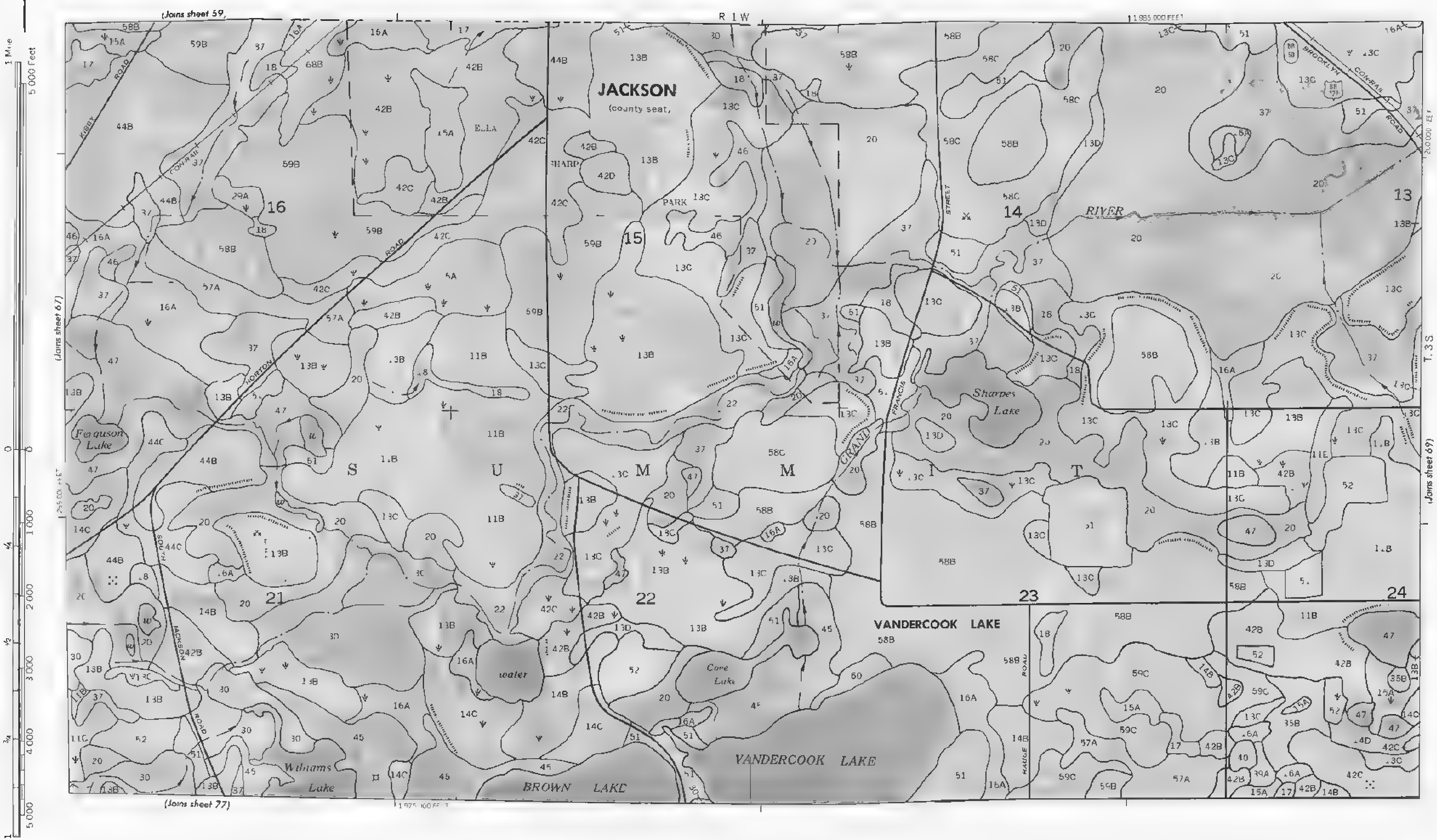

63
N
R 2 E
(Joins sheet 54)
(Joins sheet 62)
(Joins sheet 72)
T 3 S
GRASS LAKE
LAKE ROAD
FRANCISCO ROAD
WASHTENAW COUNTY
Willow Creek
1
2
11
12
1 Mile
5 000 Feet


N
1 Mile
5000 Feet
(Joins sheet 55)
(Joins sheet 73)
(Joins sheet 65)
R 3 W
T 3 S
CALHOUN COUNTY
C O N C O R D
BEHLING ROAD
KING ROAD
ALBION ROAD
North Branch
Kalamazoo River
water
18
17
16
15
19
20
21
22


N
R 3 W
R 2 W
(Joins sheet 56)
(Joins sheet 66)
(Joins sheet 74)
(Joins sheet 64)
KING
ROAD
CONCORD
NORTH
SPRING
ARBOR
C O N C O R D
S P R I N G P O R T
13
14
15
18
19
22
23
24
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000

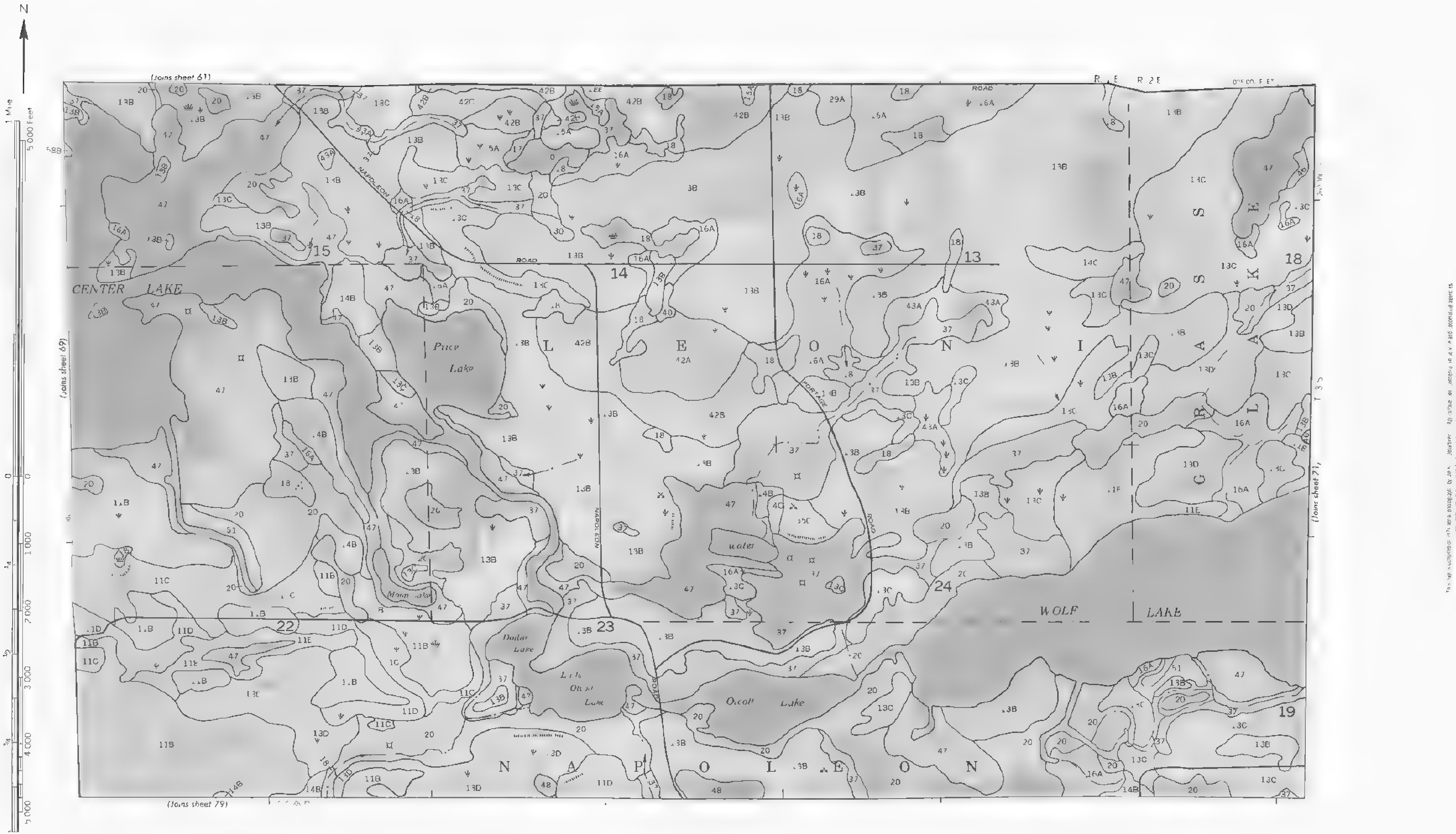

N
(Joins sheet 57)
R 2 W
(Joins sheet 65)
(Joins sheet 67)
(Joins sheet 75)
T 3 S
S P R I N G A R B O R
Spring Arbor
SPRING ARBOR ROAD
KING ROAD
ROAD
CONRAIL
LIME LAKE
water
14
15
16
17
20
21
22
23
5,000 Feet
Mile


67
N
R 2 W | R 1 W
(Joins sheet 58)
(Joins sheet 66)
(Joins sheet 68)
(Joins sheet 76)
T 3 S
Spring
Arbor
Lakes
Peterson
Lake
KIBBY
ROAD
CONRAIL
NORTON
ROAD
S P R I N G
A R B O R
S U M M I T
13
14
17
18
19
20
23
24
5 000 Feet



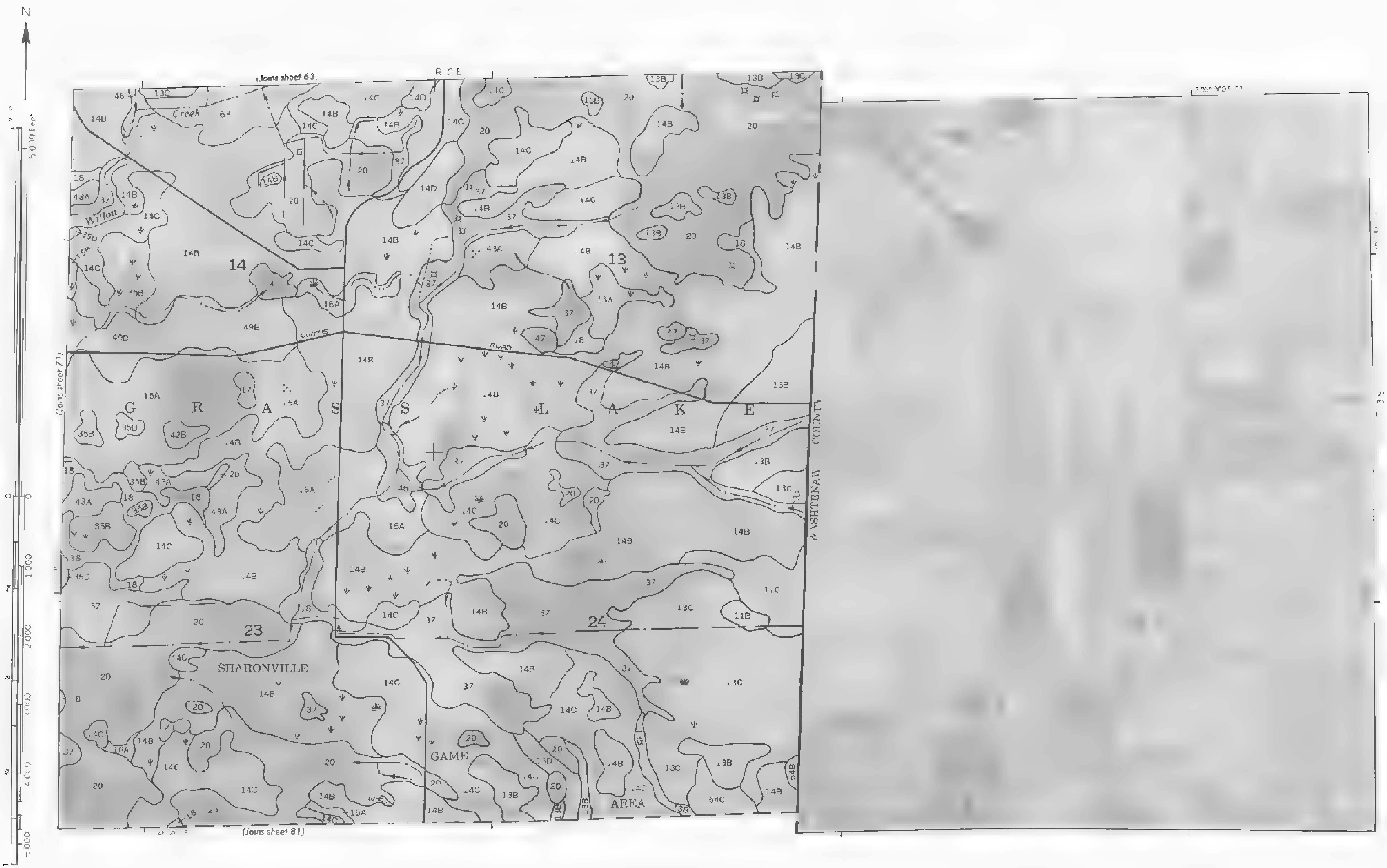
This map is compiled on [illegible] aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
R 1 W
Joins sheet 60
(Joins sheet 70)
(Joins sheet 68)
(Joins sheet 78)
GRAND RIVER
NAPOLEON
CENTER LAKE
Maple Island
Goat Island
ACKERSON LAKE
Mud Lake
Schoolhouse Lake
CEMETERY
SOUTH STREET
BROOKLYN
MERIDIAN
CONRAIL
CLARKS LAKE ROAD
13
17
18
16
19
20
21
24
5000 Feet
1000
2000
3000
4000
5000

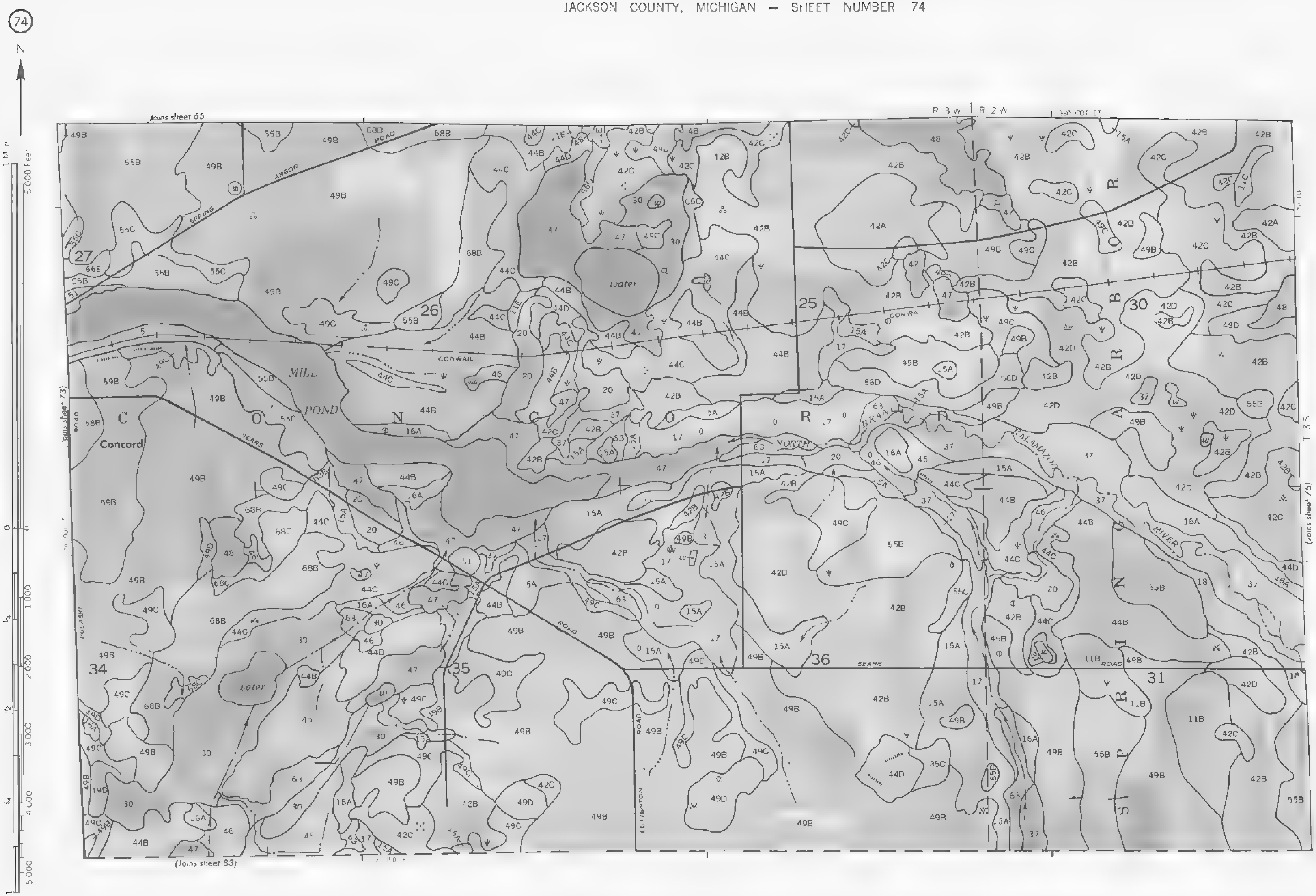

70
N
(Joins sheet 61)
(Joins sheet 69)
(Joins sheet 71)
(Joins sheet 79)
CENTER LAKE
Price Lake
WOLF LAKE
Dollar Lake
Ocot Lake
water
LEONI
NAPOLEON
GRASS LAKE
ROAD
NAPOLEON ROAD
PORTAGE ROAD
15
14
13
18
22
23
24
19


71
N
(Joins sheet 62)
(Joins sheet 72)
(Joins sheet 80)
(Joins sheet 70)
WOLF LAKE
LITTLE WOLF LAKE
G R A S S L A K E
N A P O L E O N
SHARONVILLE
GAME AREA
Willow Creek
water
17
16
15
18
19
20
21
22
1 Mile
5000 Feet

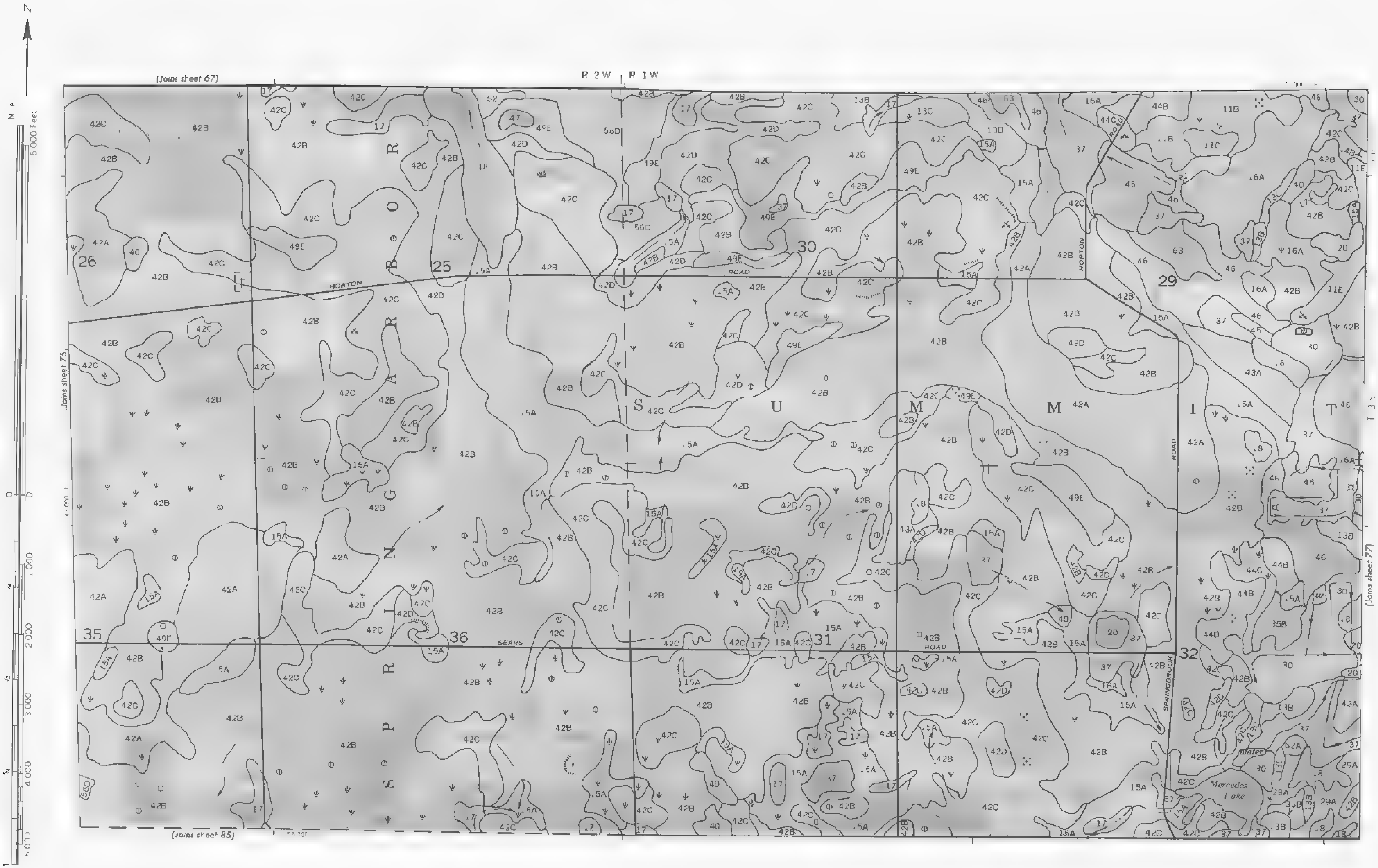
72


N
(Joins sheet 63)
R 2 E
Creek
Willow
14
13
23
24
CURTIS
ROAD
G R A S S L A K E
(Joins sheet 71)
WASHTENAW COUNTY
SHARONVILLE
GAME
AREA
(Joins sheet 81)


73
R 3 W
T 3 S
(Joins sheet 64)
(Joins sheet 74)
(Joins sheet 82)
CALHOUN COUNTY
VAN WERT ROAD
HOMER ROAD
ROAD
NORTH BRANCH
KALAMAZOO RIVER
ALBION ROAD
SPRING ARBOR ROAD
HOMER ROAD
CONRAIL
PULASKI ROAD
Concord
CEMETERY
C O N C O R D
water
Mill Pond
27
28
29
30
31
32
33
34
1 Mile
5000 Feet

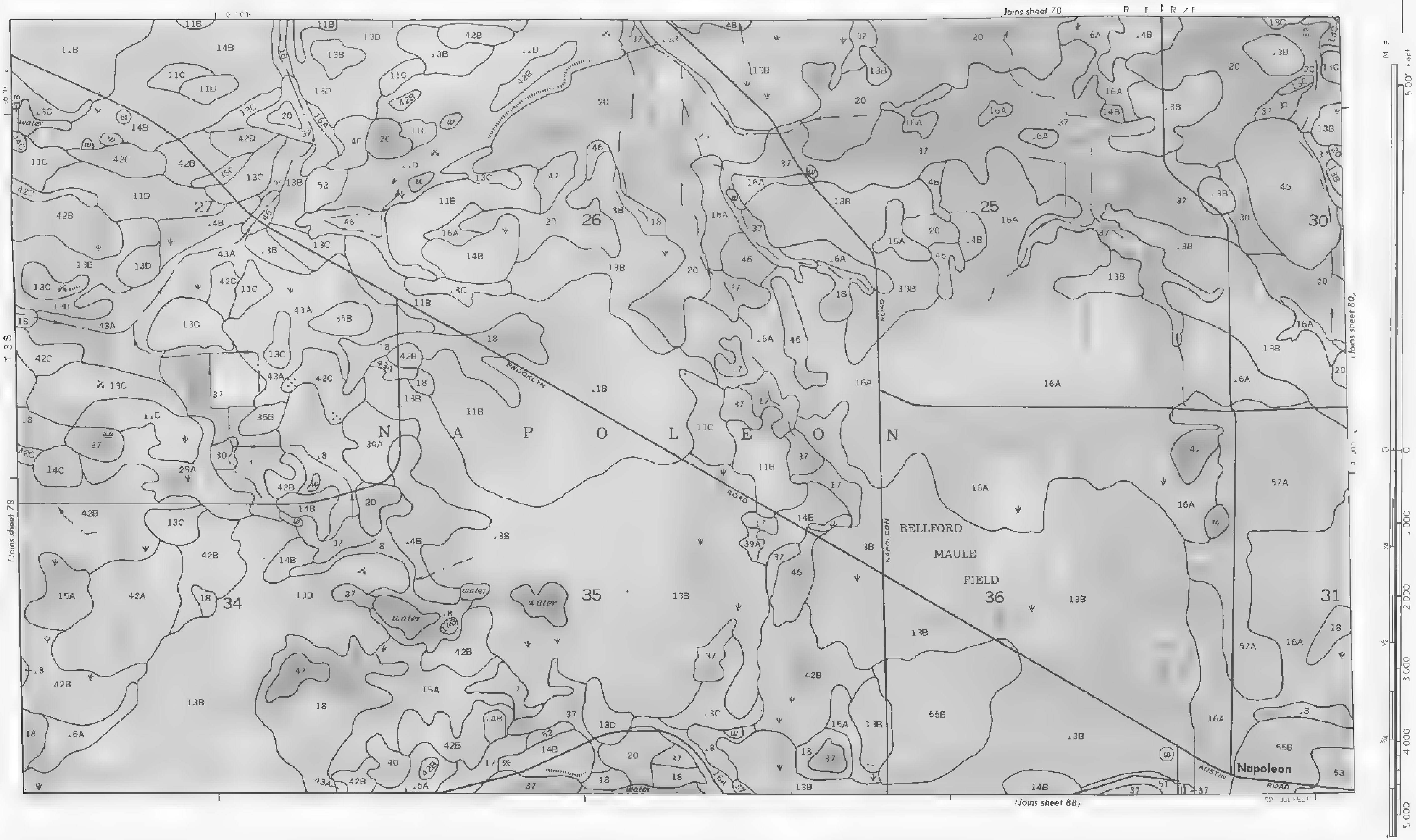

74
N
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
Joins sheet 65
(Joins sheet 73)
(Joins sheet 75)
(Joins sheet 83)
R 3 W
R 2 W
T 3 S
Concord
MILL POND
NORTH BRANCH
KALAMAZOO RIVER
SPRING ARBOR ROAD
SEARS ROAD
PULASKI ROAD
LUTTENTON ROAD
CON-RAIL
Water
27
26
25
30
34
35
36
31


(Joins sheet 66)
(Joins sheet 76)
(Joins sheet 84)
(Joins sheet 74)
R 2 W
T 3 S
LIME LAKE
Cross Lake
NORTH BRANCH KALAMAZOO RIVER
S P R I N G A R B O R
CONRAIL
HORTON ROAD
SEARS ROAD
ROAD
water
29
28
27
26
32
33
34
35
N
5000 Feet

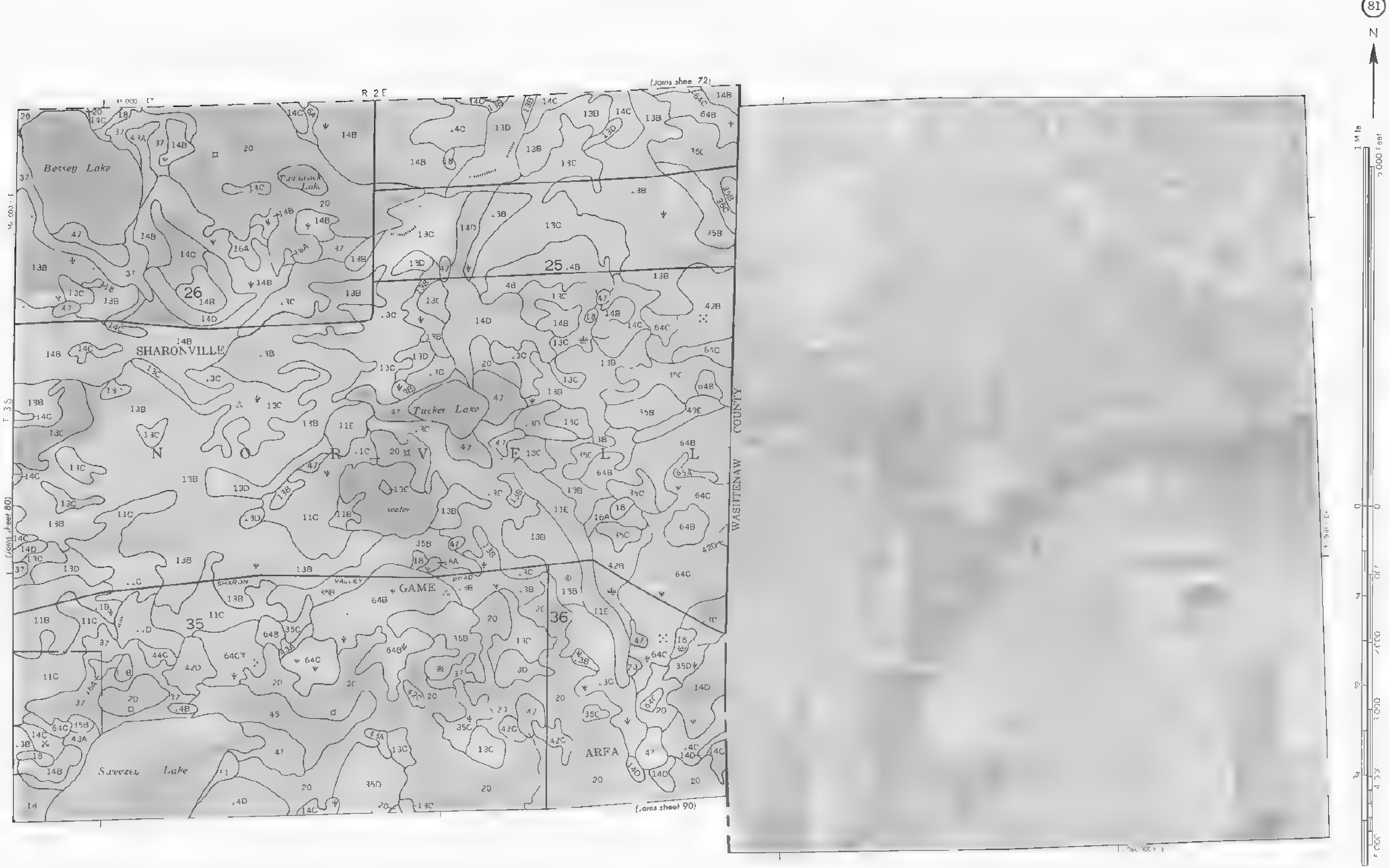

(Joins sheet 67)
R 2 W | R 1 W
(Joins sheet 75)
(Joins sheet 77)
(Joins sheet 85)
HORTON ROAD
SEARS ROAD
SPRINGBROOK ROAD
S P R I N G P O R T
S U M M I T
Mercedes Lake
Water
25
26
29
30
31
32
35
36
N
5 000 Feet

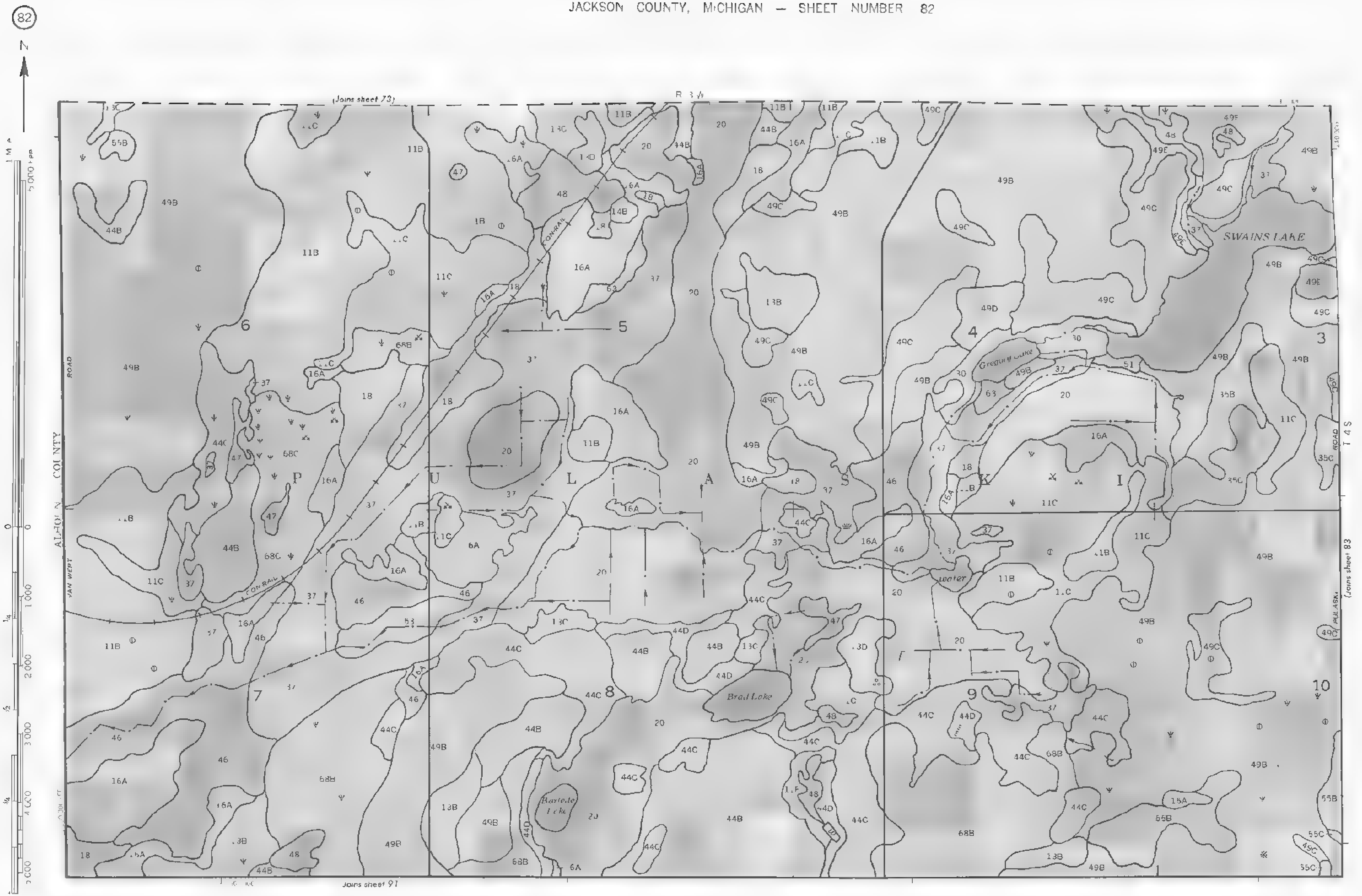

N
(Joins sheet 68)
R 1 W
Williams Lake
BROWN LAKE
VANDERCOOK LAKE
Pinton Lake
GRAND
RIVER
Sharp
water
T 3 S
S U M M I T
28
27
26
25
33
34
35
36
JACKSON
SOUTH
(Joins sheet 78)
Joins sheet 76
(Joins sheet 86)
5 000 Feet
1 000
2 000
3 000
4 000
5 000

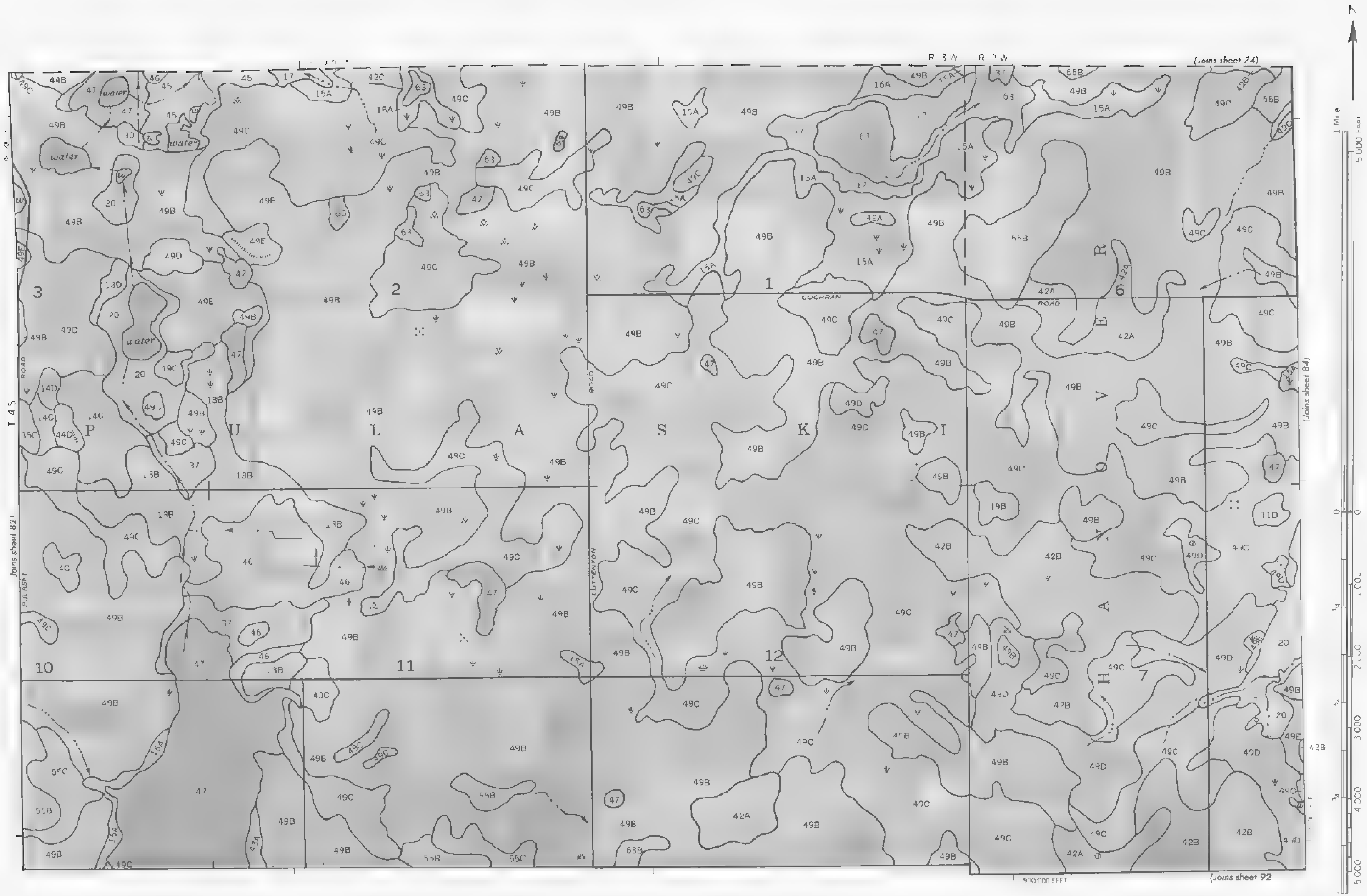
JACKSON COUNTY, MICHIGAN — SHEET NUMBER 78


79
N
Joins sheet 70
(Joins sheet 78)
(Joins sheet 80)
(Joins sheet 88)
T 3 S
N A P O L E O N
BELLFORD
MAULE
FIELD
Napoleon
BROOKLYN
ROAD
NAPOLEON ROAD
AUSTIN ROAD
25
26
27
30
31
34
35
36
water


80
N
(Joins sheet 71)
(Joins sheet 79)
(Joins sheet 81)
(Joins sheet 89)
SHARONVILLE
GAME
AREA
N O R V E L L
N A P O L E O N
Mellencamp Lake
water
29
28
27
30
31
32
33
34
WOLF LAKE ROAD
NORVELL ROAD
SHARON VALLEY ROAD
0
1000
2000
3000
4000
5000

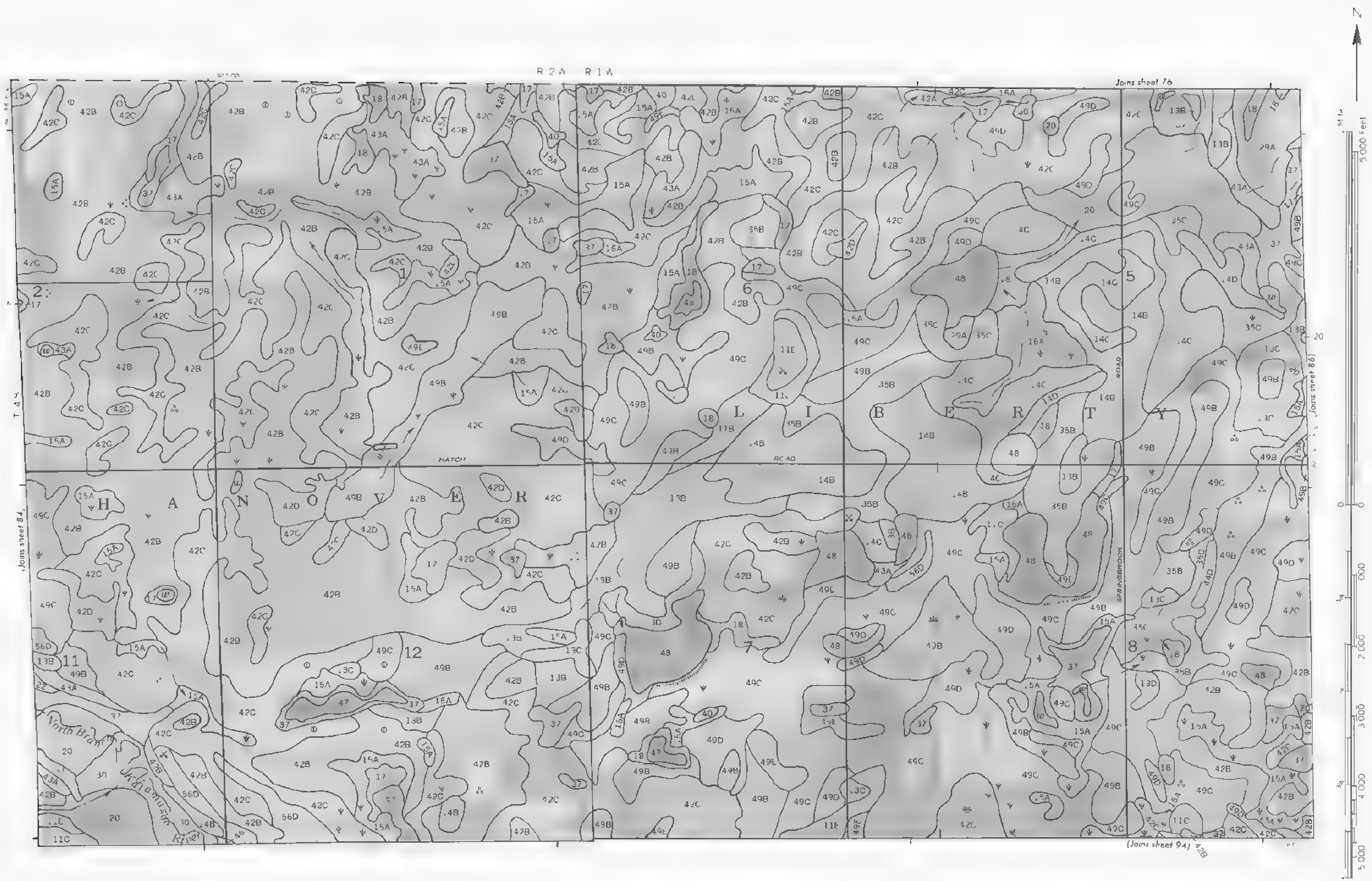

81
N
R 2 E
(Joins sheet 72)
Bessey Lake
Tucker Lake
SHARONVILLE
N O R V E L L
SHARON VALLEY ROAD
GAME AREA
Sweezey Lake
WASHTENAW COUNTY
(Joins sheet 80)
(Joins sheet 90)
25
26
35
36
water
1 Mile
5000 Feet


82
N
(Joins sheet 73)
Joins sheet 91
(Joins sheet 83)
SWAINS LAKE
Gregory Lake
water
CONRAIL
ROAD
VAN WERT
PULASKI
T 4 S
P U L A S K I

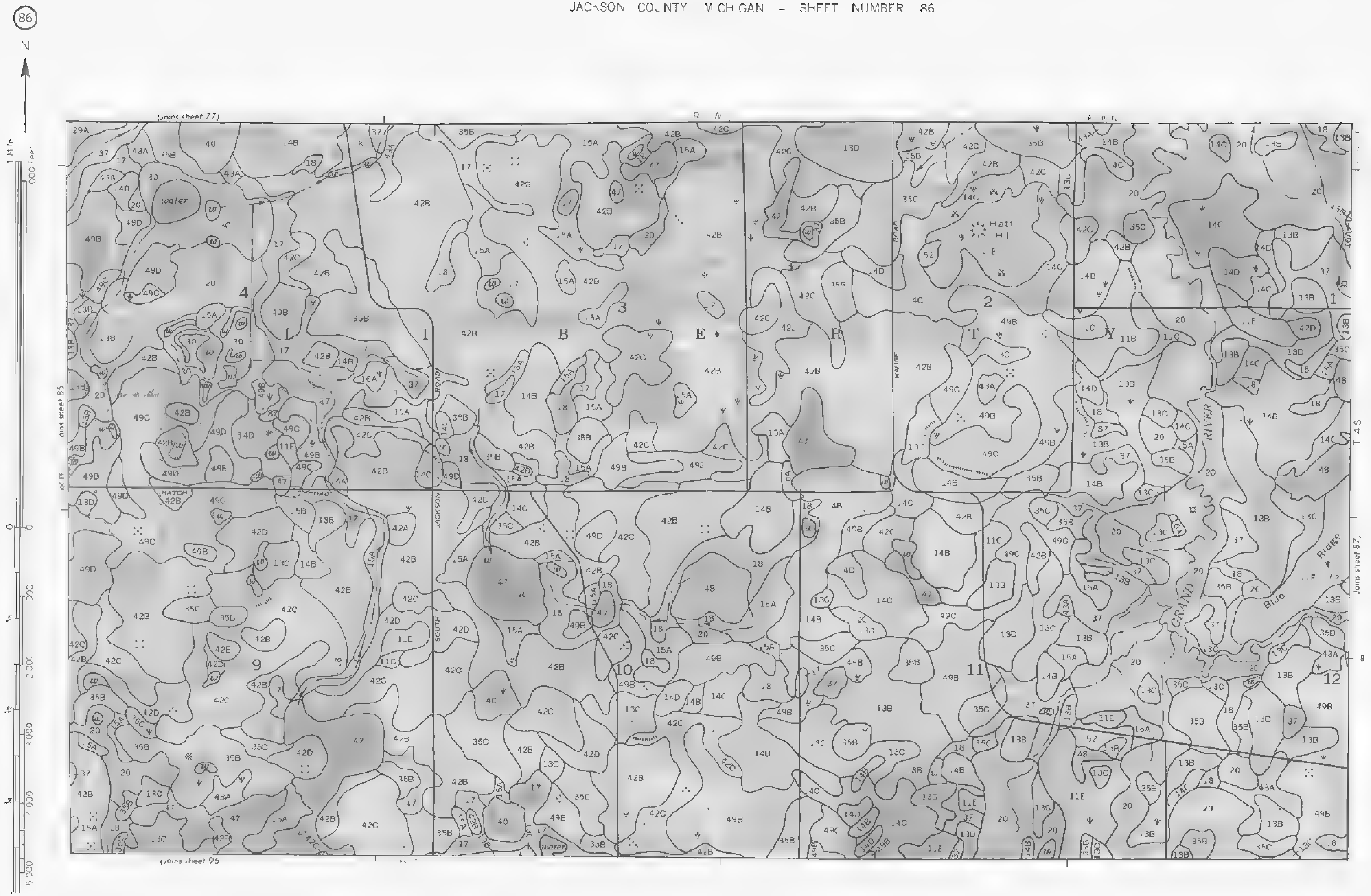


R 3 W
R 2 W
(Joins sheet 74)
(Joins sheet 84)
(Joins sheet 92)
Joins sheet 82
COCHRAN ROAD
P U L A S K I
R E V O H
water
1 Mile
5 000 Feet

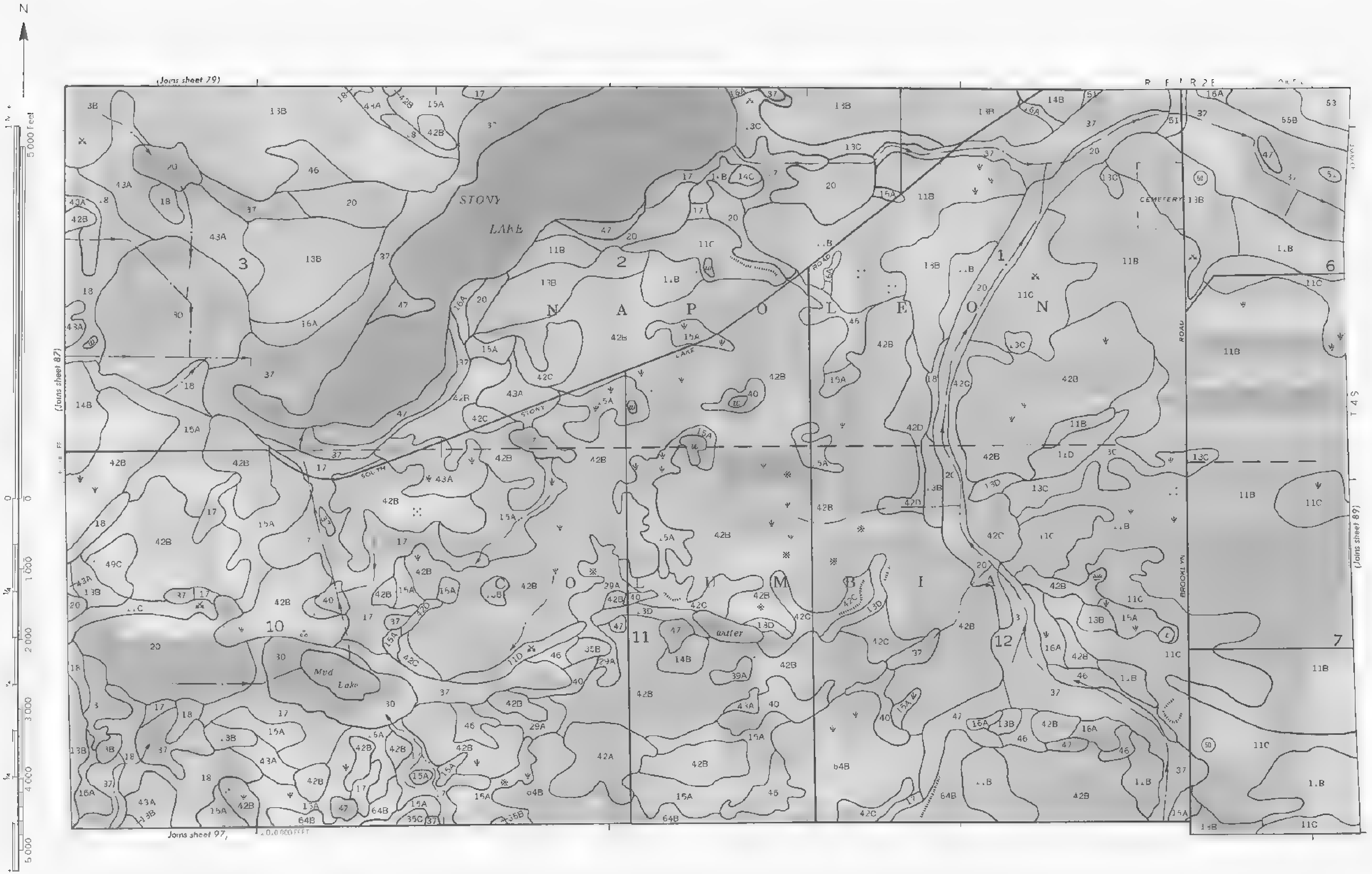
JACKSON COUNTY, MICHIGAN — SHEET NUMBER 84

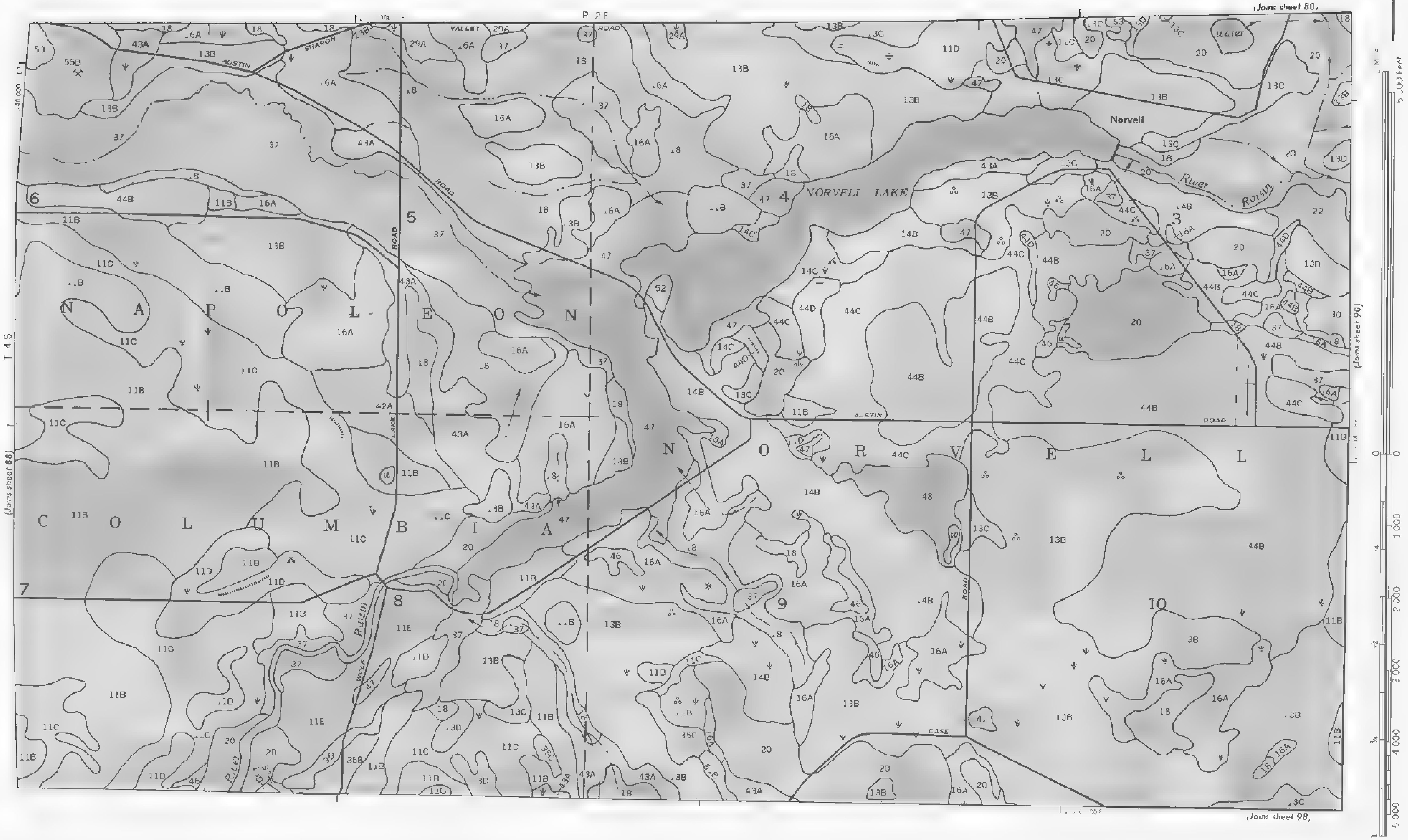

R 2 W
R 1 W
Joins sheet 76
Joins sheet 84
Joins sheet 86
(Joins sheet 94)
H A N O V E R
L I B E R T Y
HATCH
ROAD
SPRINGBROOK
ROAD
North Branch
Kalamazoo
River
N
5 000 Feet
1 Mile

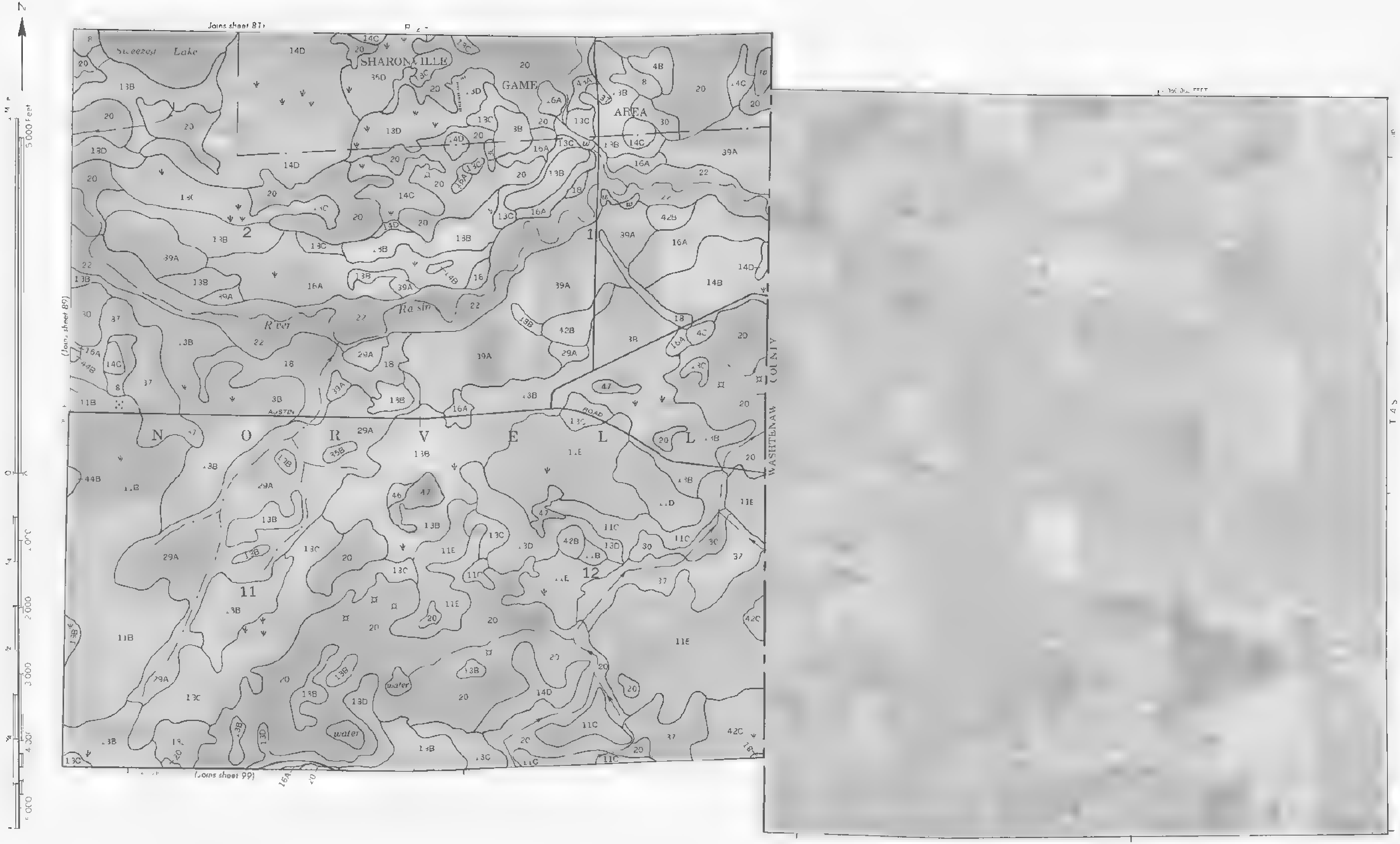
JACKSON COUNTY MICHIGAN - SHEET NUMBER 86

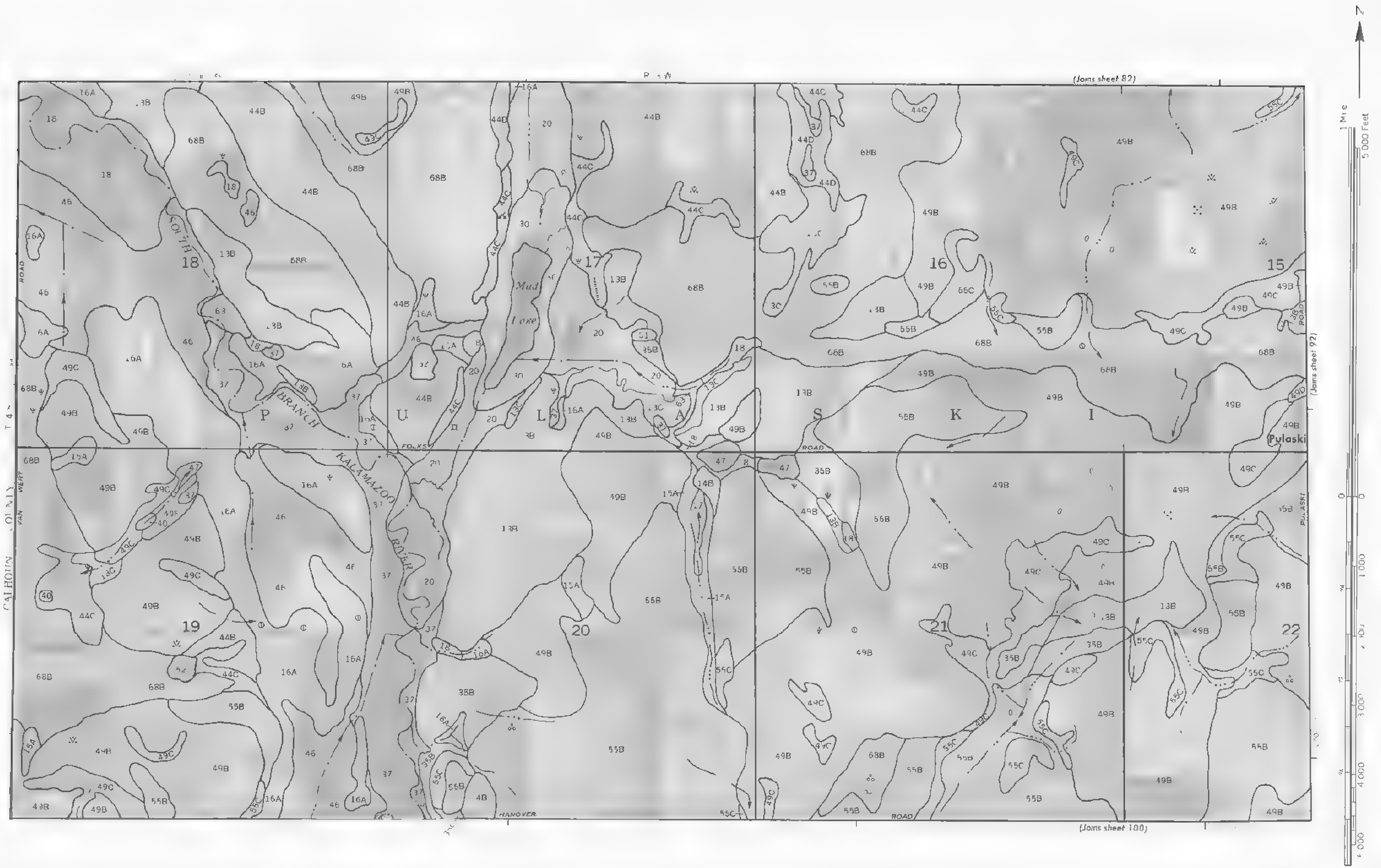


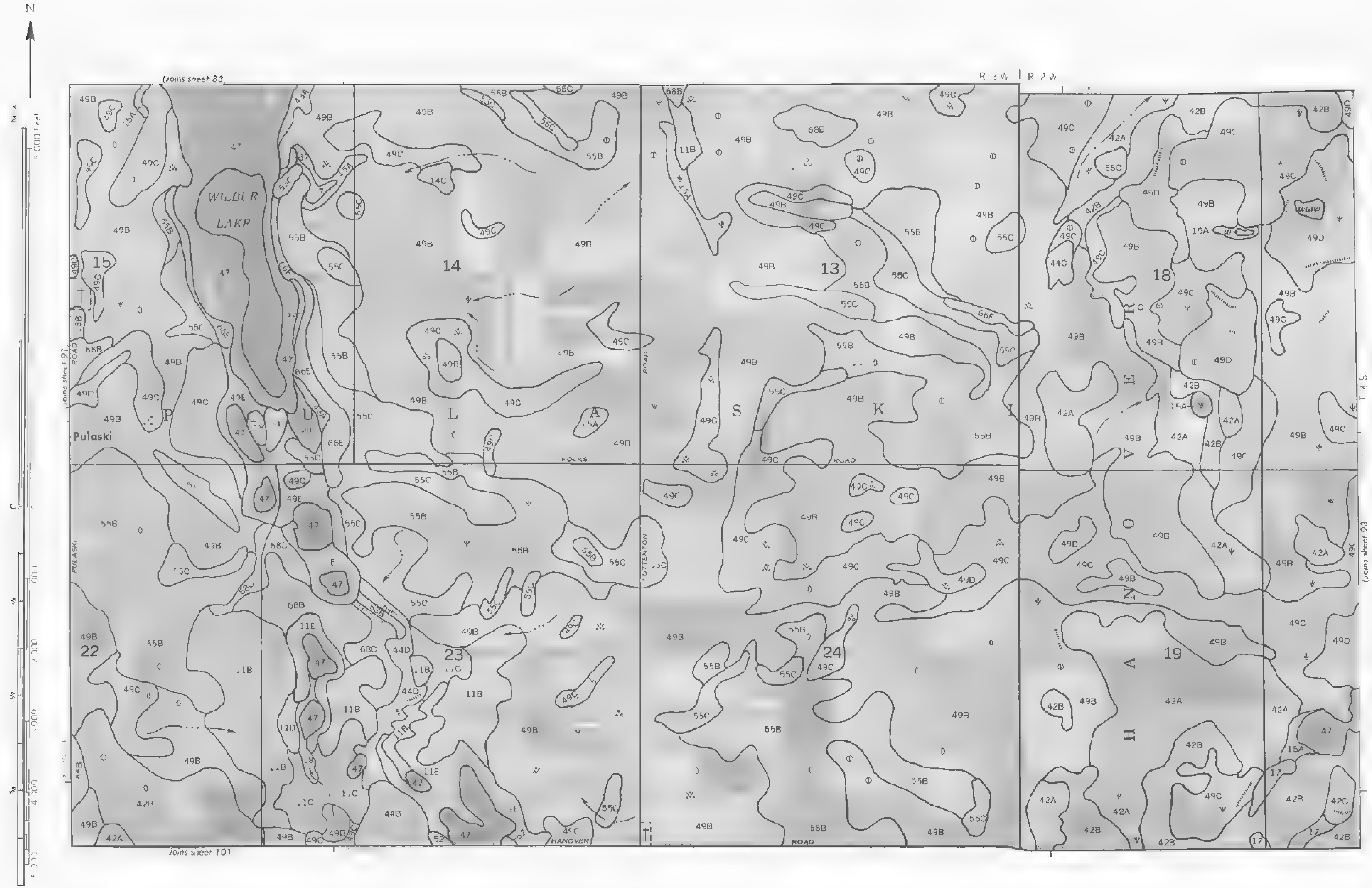

Joins sheet 78
Joins sheet 88
(Joins sheet 96)
Joins sheet 86
N A P O L E O N
C O L U M B I A
GRAND
RIVER
SOUTH STONEY LAKE ROAD
CLARKS LAKE ROAD
HYDE
MERIDIAN
ROAD
Blue Ridge
water
N
0
1000
2000
3000
4000
5000
Feet


N
5 000 Feet
(Joins sheet 79)
(Joins sheet 87)
(Joins sheet 89)
Joins sheet 97
STONY LAKE
N A P O L E O N
C O L U M B I A
Mud Lake
water
CEMETERY
BROOKLYN ROAD
T 4 S
3
2
1
6
10
11
12
7

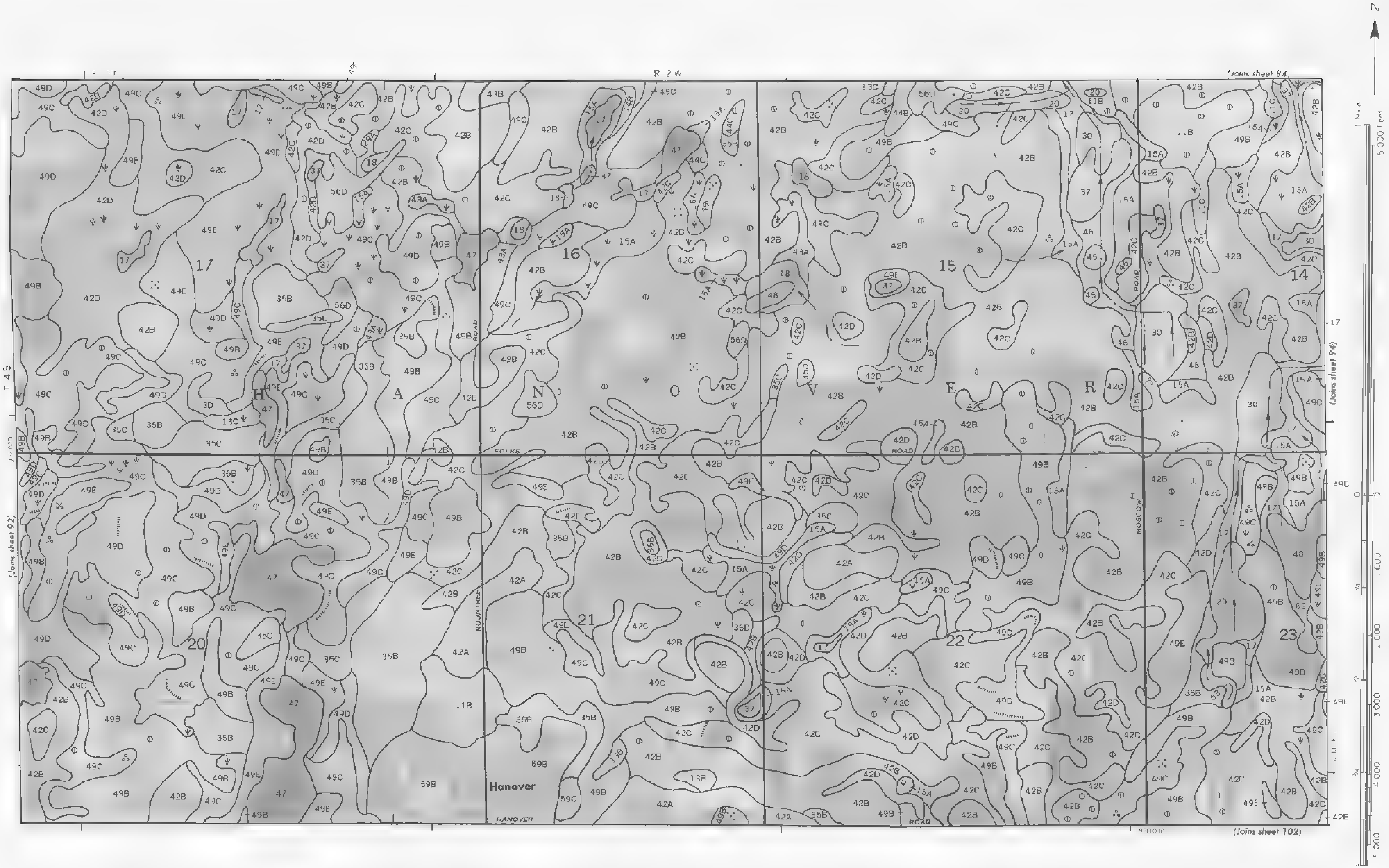

(Joins sheet 80)
(Joins sheet 88)
(Joins sheet 90)
(Joins sheet 98)
R 2 E
T 4 S
NAPOLEON
NORVELL
COLUMBIA
Norvell
NORVELL LAKE
AUSTIN ROAD
SHARON
LAKE ROAD
CASE
River Raisin
1 Mile
5 000 Feet

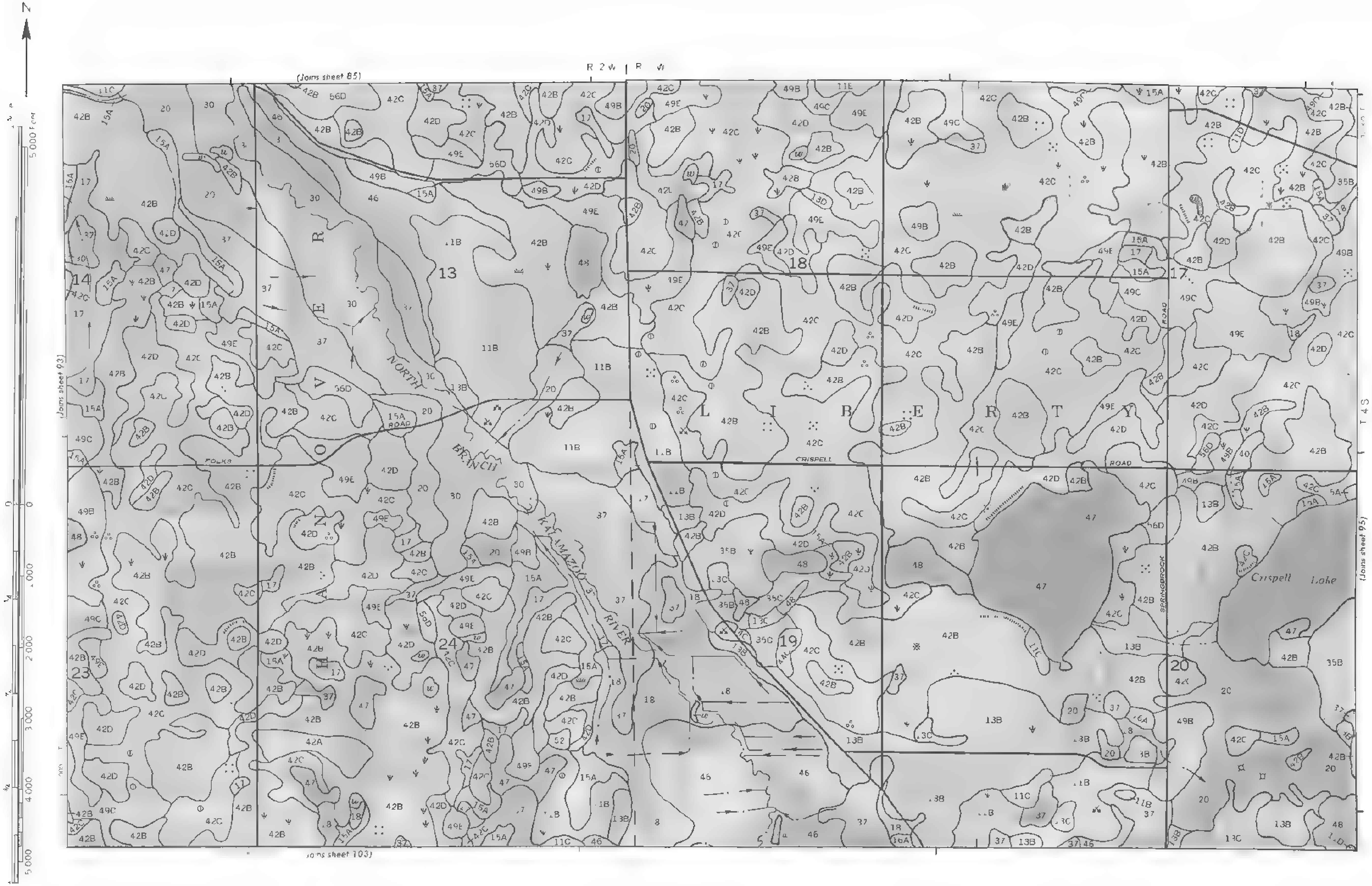

N
5 000 Feet
Joins sheet 81
Joins sheet 89
Joins sheet 99
Sweezey Lake
SHARONVILLE
GAME
AREA
River
Raisin
AUSTIN
ROAD
N O R V E L L
WASHTENAW COUNTY
2
1
11
12
water
water
14D
13B
13C
13D
14C
16A
20
22
29A
37
39A
42B
44B
47
11B
11C
11E


91
N
(Joins sheet 82)
(Joins sheet 92)
(Joins sheet 100)
1 Mile
5 000 Feet
Mud Lake
SOUTH BRANCH
KALAMAZOO RIVER
P U L A S K I
Pulaski
CALHOUN COUNTY
VAN WERT ROAD
FOLKS ROAD
HANOVER ROAD
PULASKI ROAD
16
15
17
18
19
20
21
22

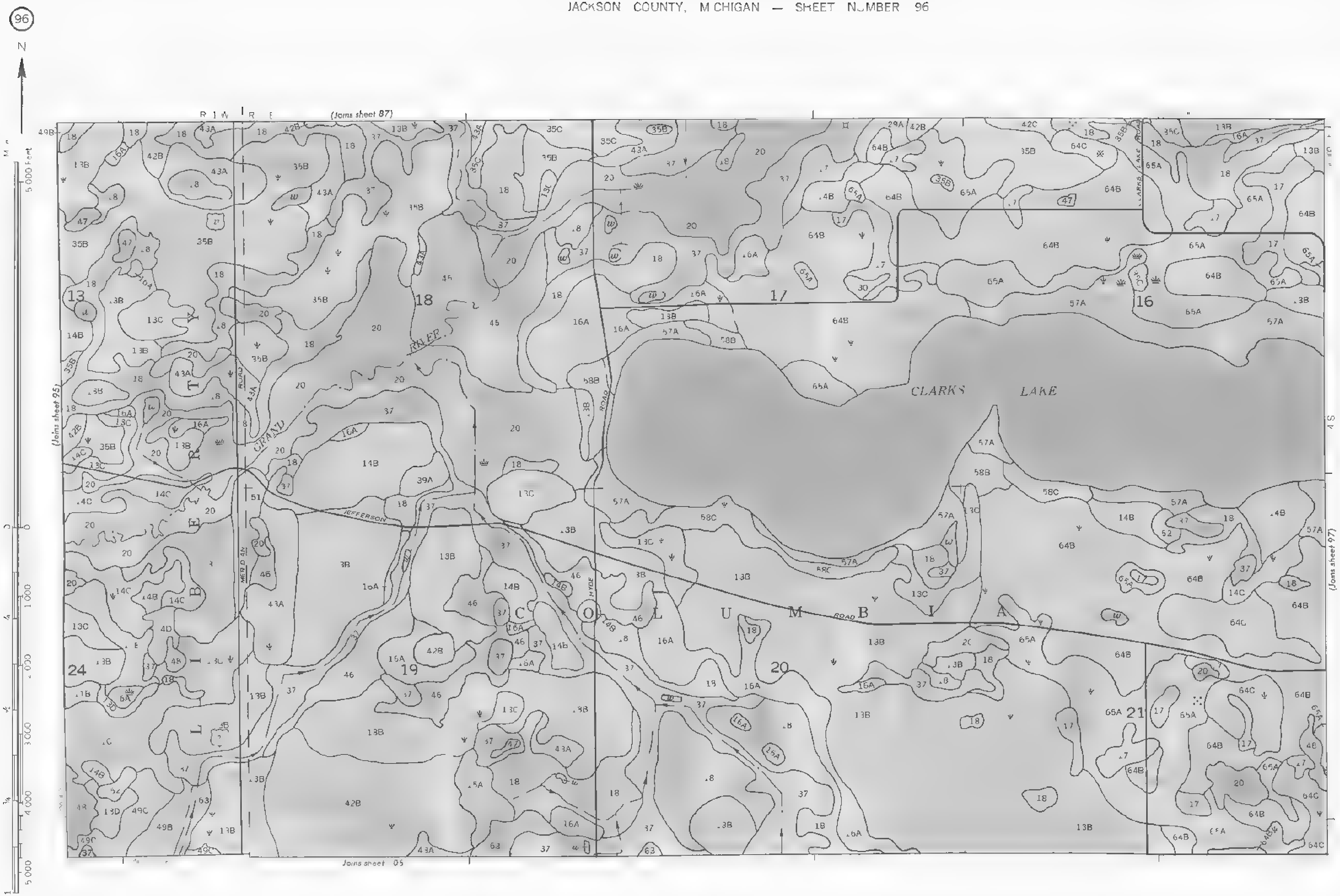

N
Joins sheet 83
Joins sheet 91
Joins sheet 93
Joins sheet 101
R 3 W | R 2 W
T 4 S
WILBUR LAKE
Pulaski
P U L A S K I
H A N O V E R
FOLKS ROAD
HANOVER ROAD
15
14
13
18
22
23
24
19

JACKSON COUNTY, MICHIGAN — SHEET NUMBER 93



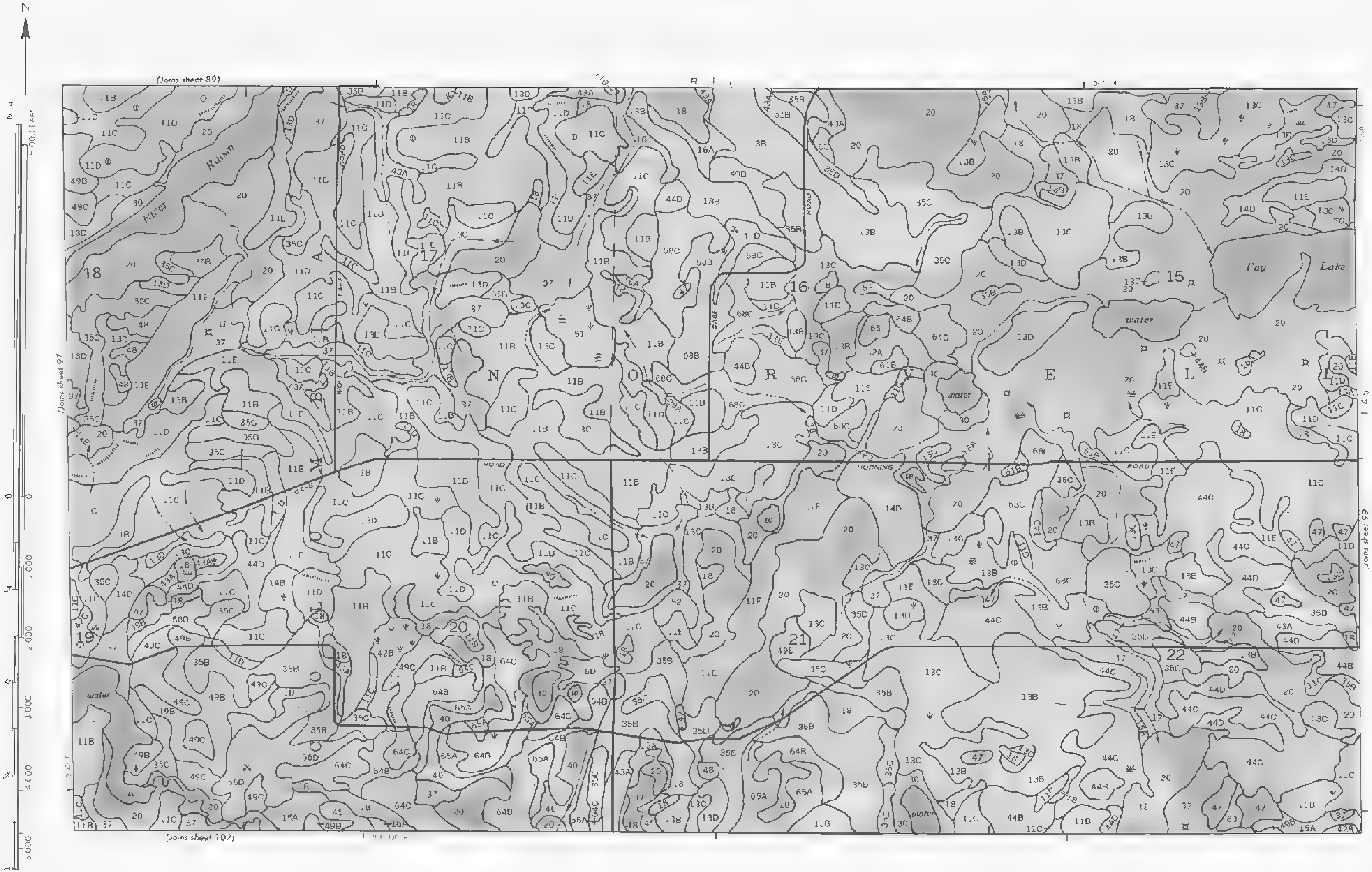

N
(Joins sheet 85)
(Joins sheet 93)
(Joins sheet 95)
(Joins sheet 103)
R 2 W
T 4 S
L I B E R T Y
NORTH BRANCH
KALAMAZOO RIVER
FOLKS
ROAD
CRISPELL
ROAD
SPRINGBROOK
Crispell Lake
13
14
17
18
19
20
23
24
5000 Feet

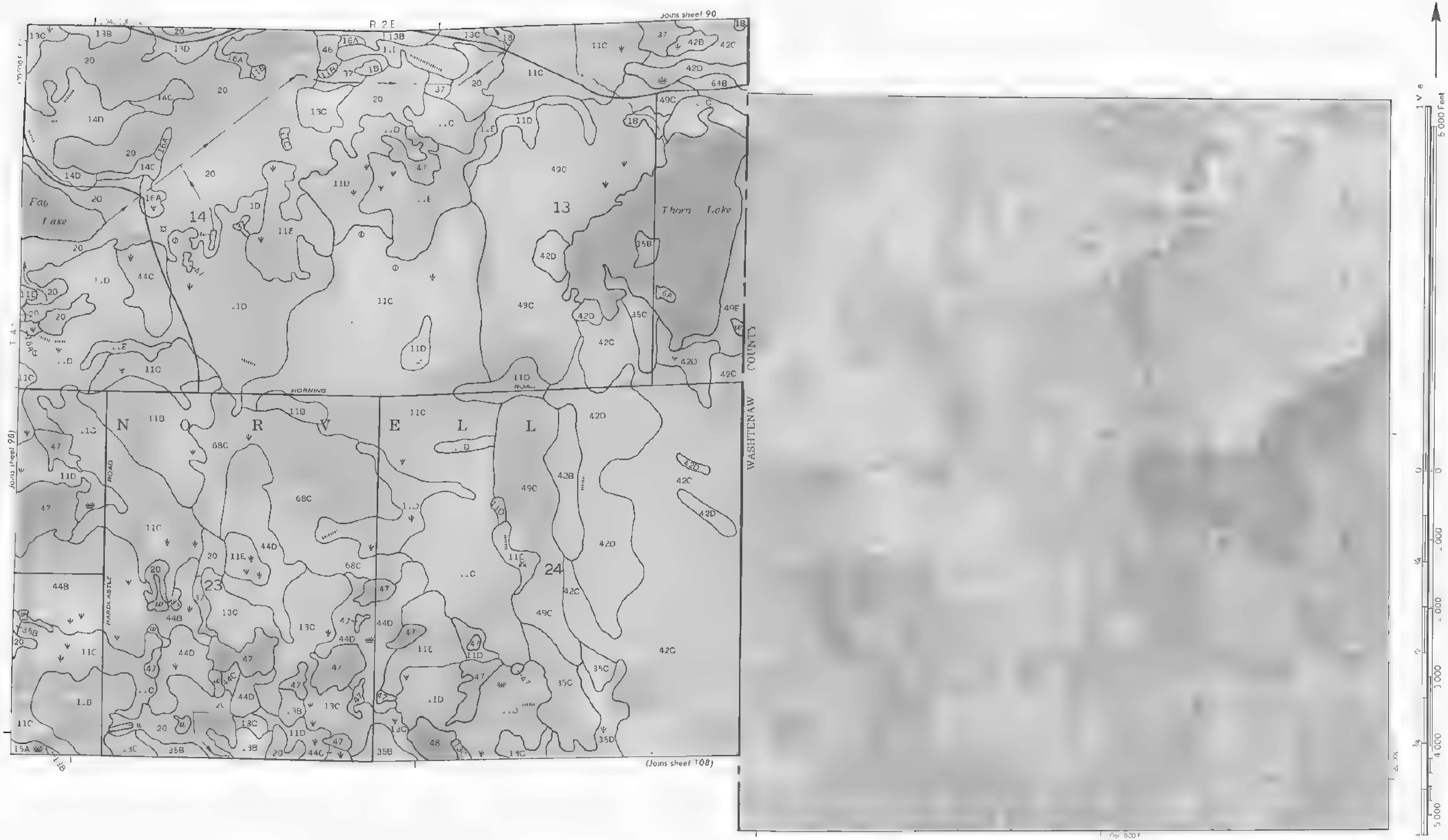

R 1 W
Joins sheet 86
Joins sheet 94
Joins sheet 96
(Joins sheet 104)
Skiff Lake
Crispell Lake
JACKSON
JEFFERSON
CRISPELL
LIBERTY
ROAD
SOUTH
GRAND RIVER
Liberty
L I B E R T Y
16
15
14
13
21
22
23
24
N
5 000 Feet


96
N
5 000 Feet
R 1 W
R 1 E
(Joins sheet 87)
(Joins sheet 95)
(Joins sheet 97)
CLARKS LAKE
GRAND RIVER
JEFFERSON ROAD
MERIDIAN ROAD
HYDE ROAD
CLARKS LAKE ROAD
COLUMBIA
13
16
17
18
19
20
21
24

97


Joins sheet 88
Joins sheet 98
(Joins sheet 96)
(Joins sheet 106)
T 4 S
CLARKS LAKE
LAKE COLUMBIA
C O L U M B I A
Goose
Creek
Raisin
River
water
Brooklyn
JEFFERSON
ROAD
CASE
CEMENT
15
14
13
18
22
23
24
19
5 000 Feet

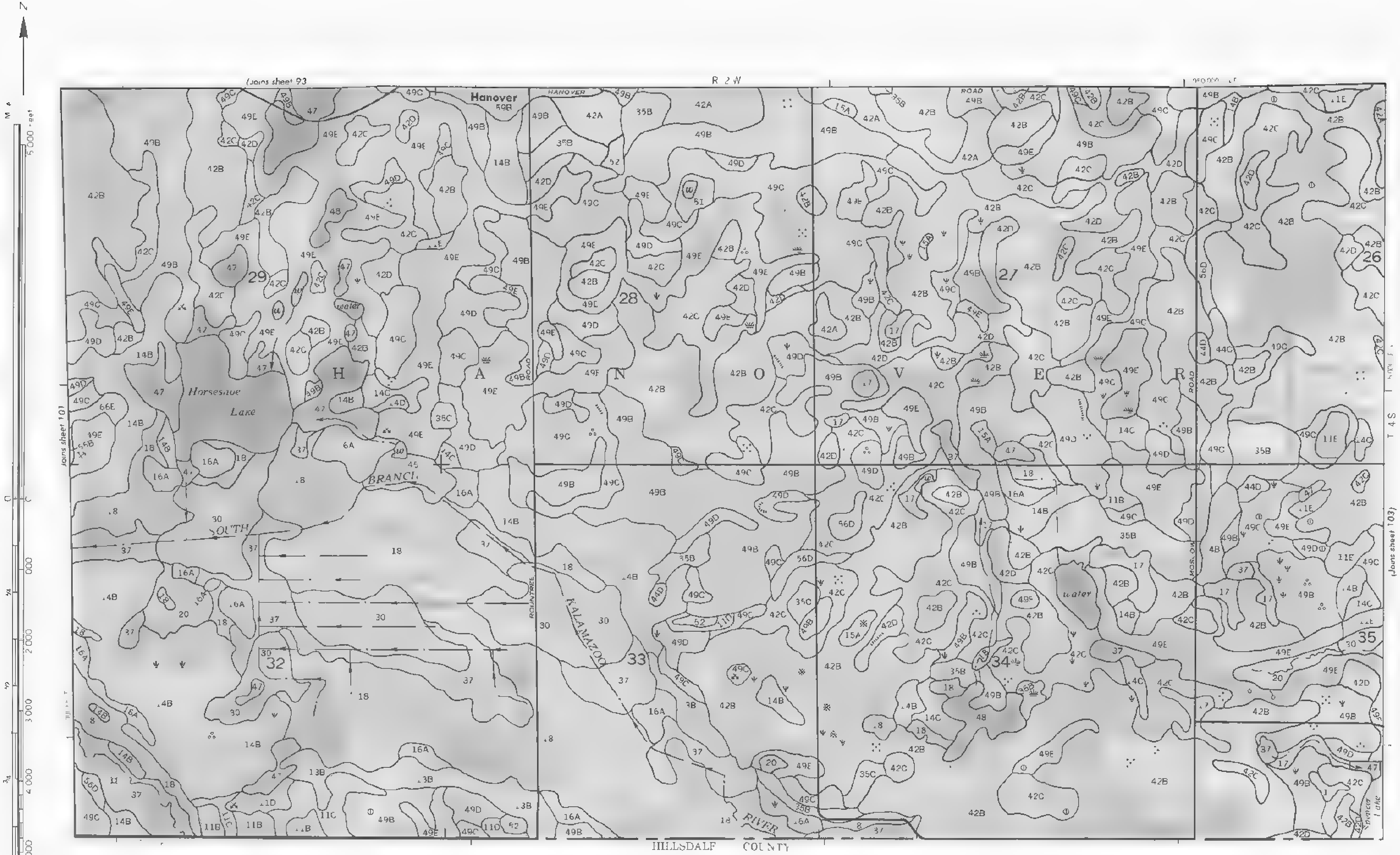

(Joins sheet 89)
(Joins sheet 97)
(Joins sheet 99)
(Joins sheet 107)
River Raisin
Fay Lake
water
CASE ROAD
HORNING ROAD
LAKE ROAD


N
Joins sheet 90
R 2 E
Fay Lake
Thorn Lake
14
13
23
24
HORNING ROAD
N O R V E L L
HARDCASTLE ROAD
WASHTENAW COUNTY
Joins sheet 98
(Joins sheet 108)
5 000 Feet

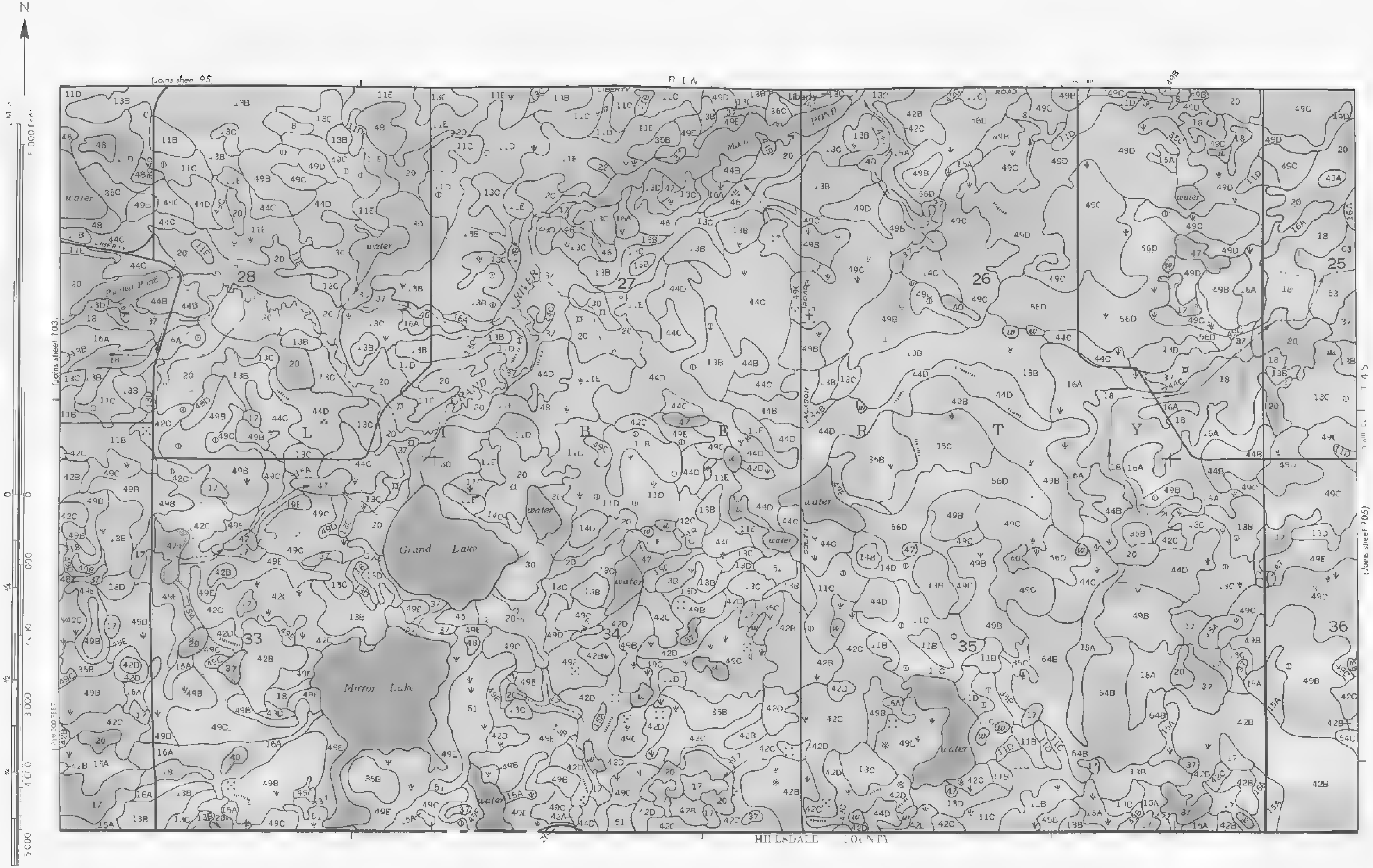

N
Joins sheet 91
R 3 W
HANOVER
ROAD
CALHOUN COUNTY
VAN WERT ROAD
HILLSDALE COUNTY
Goose Lake
South Branch Kalamazoo River
P U L A S K I
PULASKI
ROAD
T 4 S
Joins sheet 101
30
29
28
27
31
32
33
34
Feet
Mile


101
Joins sheet 92
Joins sheet 100
Joins sheet 102
R 3 W | R 2 W
T 4 S
HANOVER
P U L A S K I
H A N O V E R
27
26
25
30
34
35
36
31
Stoney Point
South Branch
Kalamazoo
River
HILLSDALE COUNTY
5 000 Feet

JACKSON COUNTY, MICHIGAN — SHEET NUMBER 102




103
N
R 2 W R 1 W
(Joins sheet 94)
(Joins sheet 102)
(Joins sheet 104)
HANOVER
LIBERTY
FAREWELL LAKE
ROUND LAKE
Pine Hills Lake
Fox Lake
Hanna Lake
water
SPRINGBROOK ROAD
ROAD
25
26
29
30
31
32
35
36
HILLSDALE COUNTY
1 Mile
5 000 Feet
0

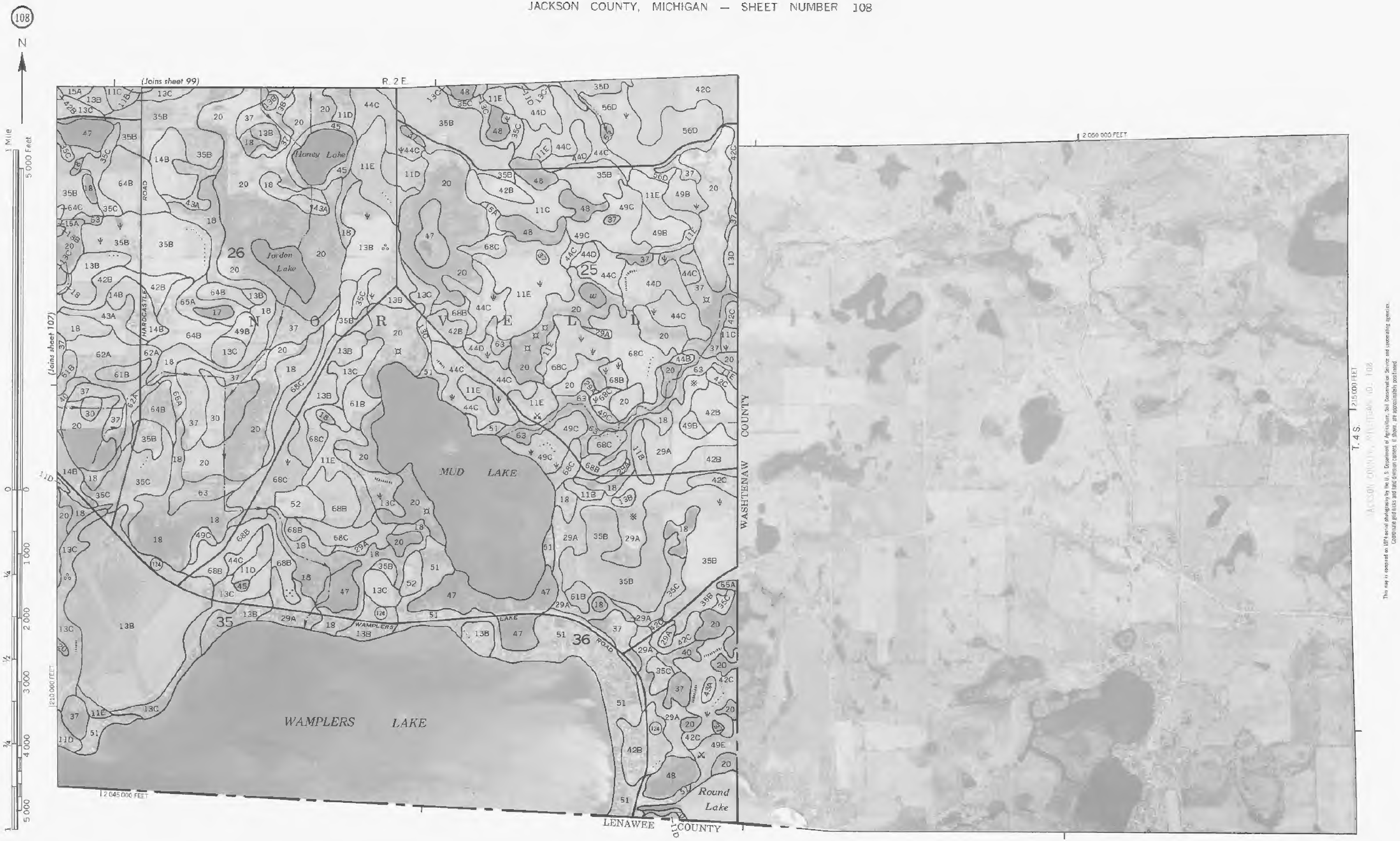

N
(Joins sheet 95)
R 1 A
LIBERTY
ROAD
(Joins sheet 103)
(Joins sheet 105)
28
27
26
25
33
34
35
36
L
I
B
E
R
T
Y
GRAND
RIVER
Grand Lake
Mirror Lake
water
JACKSON ROAD
SOUTH
HILLSDALE COUNTY

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

JACKSON COUNTY, MICHIGAN NO. 105

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


108
N
(Joins sheet 99)
R. 2 E.
(Joins sheet 107)
Honey Lake
Jordan Lake
MUD LAKE
WAMPLERS LAKE
Round Lake
NORVELL
HARDCASTLE ROAD
WAMPLERS LAKE ROAD
WASHTENAW COUNTY
LENAWEE COUNTY
T. 4 S.
26
25
35
36
2 045 000 FEET
2 050 000 FEET
210 000 FEET
215 000 FEET
1 Mile
5 000 Feet